FOUNDRY
EST. 1902 TRADE JOURNAL
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL
VOL. 103
No. 2130
AUGUST 8, 1957
Registered at the G.P.O. as a Newspaper
Offices: John Adam House, John Adam Street, London, W.C.2
Single Copy, 9d. By Post 1/-. Annual Subscription, Home 40/-, Abroad 45/- (Prepaid)

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FOUNDRY TRADE JOURNAL

Established 1902

Vol. 103 Thursday, August 8, 1957 No. 2130

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AN INDUSTRIAL NEWSPAPERS PUBLICATION

Published Weekly

Single copy 9d.; by post 1s.
Annual subscription: home 40s., abroad 45s. (prepaid)

17/19 JOHN ADAM STREET, ADELPHI, LONDON, W.C.2

'Phone: TRAfalgar 6171 (10 lines)
'Grams: Zacatecas, Rand, London

More Regulations

Though not specifically designed for application to foundries, a major impact of the proposed Special Regulations ("Factories Ionizing Radiations")* governing the use of X- and gamma-rays, etc., in factories, will be felt by makers of steel and light-alloy castings. Ionizing radiations are present in the radiological inspection departments, wherever X- and gamma-rays are used, from whatever source they may be emitted. As far as we can see, the Regulations are based on those already applied in hospitals, and as comment on the new proposals is invited, it would be as well for those bodies or individuals making representations to bear this in mind. It means that the authorities already have much experience on the one hand of X-ray requirements, but on the other, industrial conditions and the increasing use of radio-isotopes may show considerable differences in methods devised for safe usage. For instance, there may be good reasons in hospital organization to prohibit the employment of those under eighteen years-of-age in the X-ray department, which have no good basis in industry. The curriculum of instruction for foundry junior staff often includes, and rightly so, a period in the inspection and methods departments where X- and gamma-radiations are applied.

As an industry, the foundry is very humanitarian and will welcome the spirit of these draft Regulations. At first sight they do not seem very onerous, and are mainly directed to the regular and constant use of dosemeters, or dose-rate meters, by the staff. Naturally, there are registers to keep; forms to be filled in; and periodical medical examination. These preventive means are so much better to envisage than claims for lost time through illness or claims in the courts for compensation. X-ray fluoscopy and crystallography are also included in the Regulations and the physical conditions for ensuring safety are clearly set out in the draft. This draft regulation should be carefully studied by foundry executives and a decision made as to whether individual representation should be made, or through an employers' association.

As a post-script to this subject of ionizing radiations, we learn that very heavy iron castings are being used to either replace lead shielding or for use in conjunction with lead. Whilst such components are much larger than lead would be, they still work out more cheaply. We have yet to find out just what type of cast iron is specified, but at least it is a new use for this ubiquitous alloy.

* Obtainable from Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2, post free. (See page 175 of this issue.)

Featuring . . . .

SIR PATRICK HENNESSY

ONE of the most forceful and dynamic personalities in the British motor industry, Sir Patrick Hennessy epitomizes the successful man. Born at Cork in 1898, he was educated at Christ Church School in that city, and was afterwards commissioned in the Royal Inniskilling Fusiliers, in which he served during the 1914-1918 war. When the war ended he joined Henry Ford & Son, Limited, working in the foundry and in other parts of the factory. He later became production manager and subsequently travelled extensively in Europe for the company. In 1931, the Ford Company in England moved from Manchester to Dagenham, and Sir Patrick joined them as purchase manager, becoming general manager just before the outbreak of war in 1939.

During the 1939-45 war, Lord Beaverbrook appointed him to the Advisory Council of the Ministry of Aircraft Production, where he played a most important part in securing planes for the Royal Air Force. He was knighted by King George VI for public services in 1941.

When the war ended, Sir Patrick joined the board of Ford Motor Company, Limited, became managing director in 1948, and in 1950 was appointed deputy chairman; he succeeded to the Chair in April, 1956. He is also chairman of Briggs Motor Bodies, Limited, and of Henry Ford & Son, Limited, Cork, where he began his career 37 years ago. As a leader in the British motor industry, he has never failed to speak his mind on issues affecting the industry as a whole, and has campaigned ceaselessly for better roads in Great Britain. Always ready to discuss problems and new ideas with his executives, he has a quick grasp of detail, and a knowledge of his subordinates' jobs that they sometimes find surprising—even disconcerting. As a man who has reached the top on his own merit, he believes that the best educator for success is hard, practical experience, and that it does nobody any harm to gain a position of responsibility the hard way.

Sir Patrick has little spare time for hobbies, but his principal interests are his family (he has four grandchildren) and his garden.

SIR PATRICK HENNESSY

European Coal and Steel Community

From the shadow of an ideal, the European Coal and Steel Community has rapidly progressed during the four years of its existence into very active life, with definite interest—almost proprietary in the European Common Market, Euratom, and the proposed United States of Europe. So much has been written and said around all these plans and their implications that the facts have tended to become a little obscure, particularly in regard to the participation of Great Britain in the general development schemes. Six lectures which were recently given to a party of British journalists in Luxembourg, gave an opportunity for the clarification of many important points, and some of these are as follow:—

The European Coal and Steel Community, including the Saar, covers an area of 449,000 sq. miles, and in this area live 162,000,000 people which is roughly as many as there are in the United States. The active working population of 76,000,000 is greater than that of the United States. The Community, which produced in 1955 a record of 52,700,000 *tonnes* of steel and a post-war peak of 246,400,000 tons of coal, shares with Russia the world's second place in output of these products. The Community's 145 coal undertakings control 459 pits; its 355 steel companies operate 455 iron and steelworks; and iron-ore mines number 188.

The Community exercises sovereign powers over the coal and steel resources of Belgium, France, Germany, Italy, Luxembourg, and the Netherlands. In addition, several foreign delegations are accredited to the High Authority, the British delegation (headed by Sir. William Meiklereid) adhering, along with the United States and Sweden in 1952, Norway, Switzerland, Denmark and Austria in 1953, and Japan in 1954.

In action, the High Authority is charged with establishing and maintaining the common market by levelling frontier barriers, and doing away with all trade restrictions for coal and steel among member nations. This policy necessarily entails direct interest in every aspect of these basic industries, *e.g.*, research, financing of investments, the reorganization and modernization of enterprises in competition on the common market, and partial financing of technical retraining. To finance all its activities a levy is imposed of not more than one per cent. on the value of the Community's coal and steel production.

From the commencement of its activities, the High Authority was worried by the relatively poor effort devoted to research by industries in the Community, which compared unfavourably with that of the United States, USSR, and Great Britain. Since research was considered an essential element in a long-term development policy, programmes are now in being for both coal and steel which may be summarized as follows in regard to steel.

Work in Progress

Work in progress includes investigation into the comparison of the behaviour of two types of coke in the blast-furnace. This is proceeding at Dilling Steelworks in the Saar, but difficulty is being experienced in obtaining adequate supplies of coke from the Ruhr. Study is also being made of the technical conditions in steel rolling, particularly of the formation and adherence of scale, and collaboration in this work is being provided by two steelworks, 12 rolling mills, 15 works laboratories and two research centres. The collation of all results is now proceeding.

Improvement in the quality of refractory materials is another matter under consideration and it is reported that study of silica bricks in open-hearth furnaces is proceeding at 16 steelworks in four member countries. Work is also in progress (and has already been the subject of interim reports) on flame radiation at a specially-equipped station in Ijmuiden (Holland); the object of this being to improve the calorific value of the fuels used in various industries—particularly iron and steel.

A further interesting plan has been the generous provision of funds for work proceeding in Liége on a low-shaft furnace operating as a "model" blast-furnace. While coke consumption is being primarily studied, it can be confidently anticipated that other results of wide general interest will ultimately be reported.

Institute of Metals

An attractive programme has been arranged for the 49th autumn meeting of the Institute of Metals which is to be held in Glasgow from September 16 to 20. About a dozen works and research institutions are being opened for inspection including Henry Wiggin & Company, Limited (Thornliebank); G. & J. Weir, Limited (Cathcart); Babcock & Wilcox, Limited (Renfrew); British Aluminium Company, Limited (Falkirk); Bruce Peebles & Company, Limited (Edinburgh); Barr & Stroud, Limited (Anniesland); and the North British Locomotive Company, Limited (Springburn). The social side has been well catered for and includes a dinner/dance, an excursion down the Clyde, several coach tours and a visit to Edinburgh. Details are available on writing to the secretary of the Institute, Major S. C. Guillan, at 17, Belgrave Square, London, S.W.1.

Translation Service

A co-operative translation service, designed to meet the growing need in the iron and steel industry for improved facilities for obtaining translations of foreign technical literature, including Russian, is being set up by the Iron and Steel Institute in association with the British Iron and Steel Research Association. Plans are already well advanced, and a number of companies in the industry are collaborating with the institute in setting up the service. The scheme will benefit the industry in two ways; the range of available translations of technical papers will be considerably widened, while much unnecessary duplication of effort will be avoided.

Under the arrangement, translations prepared by individual companies will be passed to the central "pool" and these will be supplemented by translations from other sources.

Canadian Ingot Output Record

In the first half of this year a record tonnage of pig-iron and steel ingots was produced in Canada. Pig-iron output, at 1,923,073 tons, was 11 per cent. above the total for the first half of last year, and the 2,613,096 tons of steel ingots produced represented a 2 per cent. increase.

Output of pig-iron in June rose to 330,081 tons from 303,018 tons in June, 1956, but the total for steel ingots eased to 415,020 tons from 435,377 tons produced in the previous year. The rated ingot capacity of Canada's steel furnaces on January 1 was 5,404,000 tons a year.

Metallurgical Aspects of the Control of Quality in Non-ferrous Castings

Symposium in London Organized by the Institute of Metals

The 1957 Spring Meeting of the Institute of Metals was held in London earlier this year. It was a joint meeting with the *Associazione Italiana di Metallurgia, Associations Suisse pour l'Essai des Materiaux,* and the *Société Suisse des Constructeurs de Machines.* The programme was designed to interest members engaged in widely-differing fields of work and included a whole-day symposium on "Metallurgical Aspects of the Control of Quality in Non-ferrous Castings," arranged by the Metallurgical Engineering Committee in conjunction with the Institute of British Foundrymen. Eight papers were presented on this subject. One of the papers, "Metallurgical Control of Quality in the Production of Aluminium-alloy Castings," was published *in extenso* in this JOURNAL on April 25, and what now follow are abstracts, synopses and the conclusions from the other papers, including comments on the whole of the discussion. At the meeting, Dr. W. A. Baker acted as "rapporteur" giving first a short survey of the principal features of each paper. About 200 were present at the various sessions, which were held in Church House, Westminster.

Metallurgical Principles of the Control of Quality of Non-ferrous Castings

By R. W Ruddle, M.A., F.I.M., and A. Cibula, M.A.

A paper on the metallurgical principles involved in quality control, by R. W. Ruddle, M.A., F.I.M., and A. Cibula, M.A., formed a communication from the British Non-Ferrous Metals Research Association. It reviewed the reasons for the occurrence of defects in castings and the scientific basis of methods for the avoidance of these defects. Subjects discussed included: flow of liquid metals through the gating system and into the mould cavity; rate at which castings freeze, mechanisms of freezing in metals and alloys, and the bearing of these factors on the incidence of shrinkage porosity and on methods of feeding; other defects arising during solidification, such as hot-tears and segregation; melt quality, including the control of the gas-content, grain refinement, elimination of non-metallic inclusions, and test-bar design. Defects arising from faulty selection, preparation, and ramming of the sand are not included.

Main Sections

The Paper is divided under three main headings: "Flow of Liquid Metals," "Mechanism of Freezing—Heat-flow in Castings," and "Control of Metal Quality." Under the first, the Authors describe the functions of the gating system and its influence on casting quality. They state that the principle of the running system is that it should not allow turbulence in the stream of metal to exceed the point at which "agitation" occurs, *i.e.,* when the surface is continually broken and the resulting dross is entrained with air in the metal. "Stringent precautions are necessary," the Authors say, "with all alloys containing aluminium or magnesium, for dross is readily produced and the tenacious oxide films are particularly deleterious; with brasses, gunmetals, and bronzes, on the other hand, much more agitation can be tolerated, particularly in the alloys of high-phosphorus content which form only liquid oxidation products. The running system should also be capable of preventing any dross poured with the metal from reaching the mould cavity. Another important feature of a good running system is that it should limit the velocity of the metal sufficiently to prevent erosion where the stream impinges on the mould surface. This precaution is of greatest importance with the denser metals, such as copper and nickel alloys, as the erosive forces are due to changes in momentum which increase with the density of the metal. The position of the gates should allow an adequately smooth flow of metal to be maintained whether the mould cavity be empty or full, and temperature gradients to be set up which minimize shrinkage porosity and distortion." The Authors continue by describing an "ideal" sprue-system and a number of multiple-gate systems.

Under the second heading, "Mechanism of Freezing—Heat-flow in Castings," the Authors describe the freezing of pure metals, freezing of solid-solution alloys and those of eutectic type; heat extraction by moulds; solidification rates in castings, and general principles of feeding practice. The third heading "Control of Metal Quality" deals with the control of gas content, control of grain size, elimination of inclusions, and test-bars.

Test-bars

Speaking of test-bars, the Authors state "There are still considerable differences of opinion on test-bar design, many of which are due to failure to differentiate between the partly conflicting functions of the test-bar. Some of this confusion may arise because it is supposed that the properties of a casting are identical with those of a test-bar cast from the same melt. In actual fact, the properties of the casting, which depend upon section thickness and other factors, may bear little relation to those of the test-bar. This is particularly true of bars designed to show the mechanical properties of which the alloy is capable, the properties of the casting often being considerably inferior. The type of bar chosen for this purpose is necessarily

sensitive to composition rather than to other factors such as gas content, and may therefore be of little use for control of melt quality, though capable of detecting undesirable impurities and incorrect alloying and heat-treatment. The composition of certain alloys (*e.g.*, high-tensile brass) may be estimated from the appearance of the fracture of chill-cast bars. The difference between the properties of the casting and those of the test-bar is not quite so marked with test-bars designed to give a check on melt quality; these bars should be sensitive to: (*a*) the presence of inclusions, (*b*) gas content, and (*c*), in certain alloys, grain-refining treatment. When the melt quality is good, the properties of the bar should be consistently high (though it must be remembered that gas-free metal may not be suitable for poorly-fed castings). Provided that these conditions are satisfied, the precise design of the test-bar may be chosen to simplify the machining required before testing." A number of other types of test-bars are mentioned by the Authors.

Rôle of Statistical Methods in Controlling the Quality of Non-ferrous Castings

By A. R. Martin, B.Sc.

The paper on statistical control was presented by Mr. A. R. Martin, B.SC., and aims at bridging the gap between foundry practice and the standard text-books on this method of process control. Methods applicable to foundry purposes are discussed, and a consideration of conventional ways of treating and presenting test-data is used to lead up to worked examples showing how the appropriate statistical approach is selected and the results which may be expected from its application. Under the section headed "Controls Applied in the Foundry," the Author examines in detail the factors involved in establishing control, states the objects of the system and demonstrates conventional methods of presenting the data. He says "The calculated content of an element provides a reference and a criterion of control. Small variations in composition (causing a small scatter about the values expected from the charge calculation) may be expected to arise from: (*a*) minor errors in charge weighing; (*b*) variations in the composition of the components of the charge; (*c*) loss or gain during remelting and/or holding; (*d*) mixing the charge; (*e*) variation in the analytical method (and sensitivity of the method to operator technique); (*f*) progressive loss or gain of an element, and (*g*) zero drift or some other bias in the analytical method."

Types of Control

The Author then describes various methods of control, *viz.*, control by chemical analysis, control by tensile properties, sand tests, hardness tests, visual/radiological inspection, and dimensional checks. When speaking of control by tensile properties, Mr. Martin lists the following as factors influencing the tensile properties of castings: chemical composition; gas content; grain size; non-metallic-inclusion content; feeding conditions, and heat-treatment. "Small random variations in the test-bar properties," he says, "will result from minor fluctuations in all the above conditions. For this reason, it is essential that the design of the test-bar casting and its gating and riser system should be such that variations in feeding conditions will be at a minimum. Unless this is so, it will be impossible to judge the effects of other factors without recourse to the analysis of variance. Systematic trends in tensile properties may arise from such factors as: progressive build-up of chemical impurities; progressive increase in grain-size due to recirculation of process scrap derived from castings poured at high temperatures and progressive increase of non-metallic inclusion content due to the recirculation of process scrap. Wide variations in the properties may usually be assigned either to casting defects occurring in the gauge-length of the test-bar casting, or to incorrect treatment of the melt, or to incorrect heat-treatment. The purpose of the control system is: To indicate the degree of consistency in the working conditions by the range of the control limits and by the number of results lying between the control limits; to define systematic trends, and to draw attention to results falling outside the limits (calling for a metallurgical examination of the material) and to the frequency with which they occur."

Examples

The Author continues by giving examples of statistical control methods. Speaking of hardness tests, he states "Hardness testing is widely used as a check on response to heat-treatment and on the uniformity of the response of castings within a heat-treatment load. In particular, light-alloy piston castings are generally released to the customer to agreed Brinell-hardness limits. It is usual to employ a load of 1,000 kg. and a 10-mm. dia. ball." The Author enumerates the factors involved in visual inspection thus, "A rough visual inspection is usually carried out immediately after casting, and a more critical and thorough examination is made before despatch. Unfortunately, each casting produced must be regarded as an individual. This applies particularly to sand castings. It is still true also of gravity- and pressure-die-castings, although as the casting operation becomes more highly mechanized, the potential uniformity improves, and therefore sampling methods are not in this case normally applied at the final inspection stage, though they may be applied at the rough inspection stage.

Random defects occurring in castings may be grouped as: (1) Those associated with the moulding operation, such as bad finish, included sand, misplaced cores: (2) those associated with the pouring, such as flow marks, included oxides, entrapped air, cold shuts or misruns, cracks, and surface shrinkage. Systematic defects are normally associated with castings techniques or possibly with the design of the casting. Because they are attributable to the same causes as the random defects,

there may be some difficulty in recognizing them as systematic. One of the aims of a system of control is to enable this to be done in the shortest possible time. The approach to the problem of establishing suitable inspection techniques depends on a variety of factors, including the design of the castings, the casting method, alloy, customers' special requirements, or end-use of the components. As already stated, the rough inspection may be carried out on a percentage basis in the case of gravity and pressure-die-castings. Usually, faults are corrected at the beginning of a day's production." Discussing factors involved in radiological inspection, the Author says "Internal defects in castings are attributable to unsoundness or to included air or dress. The unsoundness may take the form of distinct shrinkage cavities in alloys of small freezing-range, or dispersed shrinkage porosity in alloys of long freezing-range. Alternatively, it may occur as gas porosity resulting from ineffective metal treatment. Entrapped oxide films may result from ineffective metal treatment or may have been introduced by turbulence during pouring. As for visual defects, internal defects will be systematic when associated with a faulty casting technique or faulty casting design, and random when associated with careless metal treatment, moulding or pouring. Since radiography is both expensive and time-consuming, it is normally applied only to stressed aircraft castings and because of the conditions of service, no attempt to save time and reduce costs by sampling could be justified."

The Author describes dimensional checking and such non-destructive methods as pressure testing and forms of destructive testing such as fracture examination.

Quality Control of Copper-base Alloy Castings

By A. R. French, F.I.M.

The contribution by A. R. French, F.I.M., deals with those copper-base alloys most commonly used for making castings, *i.e.*, alloys included in British Standard Specification 1,400. Although brief mention is made of chill casting, the paper is principally concerned with those made in ordinary sand moulds. Before the ranges of alloys and the properties upon which they depend for their service applications are considered, the constitution and the effects of composition and structures on properties are discussed. The influence of impurities and reducing gases is dealt with separately, and the control of melt quality is described in a section on alloying and melting practice. This is followed by a discussion of tests for metal quality. The modes of solidification of the two groups into which these alloys fall are considered, and a final section is devoted to the control of casting quality, in which reference is made to factors such as feeding and gating.

Chill Casting

Referring to chill casting of copper/tin alloys, the Author states "The techniques recommended for the manufacture of chill-cast solid and cored stick have been clearly set out in a booklet by the Tin Research Institute. Cast-iron moulds are normally used, although copper moulds are recommended, and these are usually split so that they can be cleaned and dressed. For dressing, aluminium powder suspended in a resinous carrier has been suggested, although various oil-, water-, or spirit-base dressings are frequently used. Wrong choice of, or lack of care in the application of dressings can lead to "blowing" from the mould surface to form large gas-holes, subcutaneous gas-porosity in the form of small holes, surface inclusions, and "tin sweat." The moulds are poured vertically, usually through a carefully prepared tundish, with more than one (in the case of cored sticks) hole to control the rate of flow of the metal, which should be poured hot at the minimum rate that will enable the mould to be filled without cold shuts. The phosphor bronzes lend themselves readily to this method of casting, but more difficulty is experienced with the gunmetals, in particular with the lead-free gunmetals, where an increased pouring rate is necessary."

Sand Castings

Discussing sand casting of high-tensile brasses and aluminium bronzes, Mr. French says "Foundry techniques for these alloys have to be directed towards avoidance of the entrapment of oxide-films, which are readily formed, and towards ensuring directional solidification, so that adequate feeding takes place to offset the high shrinkage that occurs during solidification. While the high-tensile brasses are less troublesome than the aluminium-bronzes, the principles are the same for both groups and it is therefore convenient to consider them together.

To avoid oxide inclusions, it is necessary to avoid turbulence, and for this reason bottom pouring is adopted. Precautions have to be taken to keep the downgate full, and although a tapered variety is preferable to ensure a full downgate and a clean flow, the parallel design, with chokes, is frequently employed. A disadvantage, however, arises with the parallel downgates in that air can be induced into the metal stream to form oxides. A sump under the downgate is valuable in steadying the flow of metal, and usually between the downgate and the ingate a suitable dirt-trap is incorporated. Entry to the mould through a small ingate, with the metallostic pressure producing jets or fountains of metal, is clearly undesirable. There is every advantage in pouring the metal as quickly as possible, compatible with the avoidance of turbulence. It is important to avoid as far as possible the meeting of streams of metal, as this frequently results in the entrapment of oxide-films. Success, therefore, lies in devising suitable running and gating systems.

Feeding

Directional solidification is achieved by the use of adequate feeders on heavy sections and by the free use of chills. A difficulty arising from the use of bottom pouring is that the metal reaching the

feeders is "cold." The risks involved in topping up the feeders with hot metal cannot be over emphasized, however, unless proper precautions be taken, the metal poured into them does not stay there but penetrates deeply into the mould. In order to maintain feeders "open" sufficiently long to feed the casting adequately, it has been necessary in the past to make them very large; their total weight might be of the same order as the weight of the casting, or even higher. Size of feeders can be very considerably reduced by making use of porous-plaster insulating sleeves, which retain heat and yet give a better degree of feeding in relation to their bulk. A disadvantage is that with aluminium-bronze such as AB 2, cast at high temperatures, the temperature of the metal entering the sleeve tends to exceed 1,160 deg. C., above which an energetic exothermic reaction is likely to take place between the metal and the plaster, causing the latter to disintegrate and become ineffective as an insulator. A better alternative is the use of exothermic sleeves, so that the temperature of the cold metal reaching the feeders is considerably raised. An important precaution has to be taken in using exothermic sleeves, because the exothermic reaction can lead to gas pick-up in the feeder metal. This can result, in the case of aluminium-bronzes, in gas porosity in the casting under the feeder unless a suitable distance is allowed between the sleeve and the surface of the casting.

Quality of Magnesium-base Alloy Castings

By E. F. Emley, Ph.D., B.Sc., F.I.M., and P. A. Fisher, A.I.M.

In the paper by Dr. E. F. Emley, B.SC., F.I.M., and P. A. Fisher, A.I.M., practical steps which contribute to high quality in sand casting magnesium-base alloys are considered, and an account is given of inspection techniques designed to show whether the quality has in fact been achieved. Methods are described for examining the various possible defects so as to determine their nature and origin, and to indicate the appropriate remedy. Special points related to gravity-die-castings or arising from the effects of thermal or protective treatments are mentioned and brief consideration is given to the practical significance of various defects. Finally, some observations are offered concerning production arrangements which it is thought can facilitate the attainment of high quality. In the section of the paper dealing with control of melt quality, important practical points relating to the quality of melts of alloys containing zirconium and aluminium are first dealt with separately, followed by points on fluxing procedure applicable to all magnesium alloys. Check tests for metal quality are also considered.

Do's and Don'ts of Pouring

Under the heading "Control of Casting," the Authors enumerate points during pouring and preliminary cleaning to which attention should be paid, these being as follow: (*a*) Handle the crucible carefully so as not to break up the flux cover unnecessarily. (*b*) Before pouring, scrape the inside of the lip and pot walls on the pouring side and preferably brush the outside with a wire brush; also remove loose scale and flux from the crucible lugs and lifting hooks. (*c*) In cleaning the metal surface, begin dusting with sulphur before the flux cover is touched. (*d*) The flux cover must be gently pushed back along the metal surface for some distance from the pouring lip whilst dusting of sulphur is continued; any flux adhering to the crucible walls near the lip at the metal level should be drawn back in the process. This cleaning of the metal surface is conveniently done when the crucible has been tilted so that metal is about to enter the lip recess. If a high pouring temperature is being employed, cleaning should be done under a sulphur/boric-acid dusting, although plain sulphur is preferable for application to the falling metal stream itself. (*e*) The crucible lip should be brought as close as possible to the pouring box of the mould, the mould being raised if necessary to a suitable level above the floor. Lip-axis tilting would seem desirable, but does not appear to be used in practice. (*f*) Pouring should be as slow and smooth as possible consistent with rapid covering of the top of the downgates and gradually raising the metal in the pouring basin to the desired level. To minimize turbulence, a rectangular, rather than a round or oval, pouring basin is desirable; its size should be adjusted to the size of the downgates; smooth, steady pouring is unlikely to be achieved in practice if large basins are fitted to small castings, or *vice versa*. (*g*) Avoid allowing the metal to fall vertically to the bottom of the pouring basin. If rectangular pouring-basins are used, this can conveniently be achieved by banking up the back of the box with moulding sand to proving a shallow channel for the metal. (*h*) In pouring a number of castings from the same crucible, avoid tilting the crucible back to the vertical between each pour. The crucible should be maintained as far as possible at the appropriate angle, and if necessary, the metal should be lightly skimmed before pouring each casting. (*i*) Leave some metal unpoured in the bottom of the crucible. For zirconium-alloy melts, this should be from one-fifth to one-tenth of the charge, depending on the crucible size and the rate of pouring. Alloys of this type exhibit a settled layer of loosely-packed clusters of zirconium-rich particles which render the metal at the bottom of the crucible viscous and liable to entrap globules of flux of various sizes which may become separated from the main body of the salt-phase during the alloying process. The metal remaining in the crucible can be cast off into ingots and added to subsequent melts. Where large castings are being poured "two up", it is obviously necessary to check that sufficient metal is left in each crucible after pouring.

Other Factors

After discussing the choice and control of moulding sands, cores, chills and running techniques in

some detail, the Authors continue by examining various routine inspection techniques. There is also a section in the paper dealing with the origin and correction of observed defects and these are classified according to the tests by which their presence is disclosed. Factors influencing the production of sound gravity die-casting are quoted. The application of heat-treatment, stress-relief, and surface protection of magnesium castings as they affect the metallurgical quality of the product are pointed out and this is followed by a section dealing with the standard of quality in castings. The Authors give a few suggestions based on their experience concerning arrangements which, it is thought, can contribute to the achievement and maintenance of high quality. The conclusions reached in the paper are that close collaboration between the founder and the customer's design staff is most desirable, so that the former can suggest and discuss modifications to design features which may be difficult or time-consuming to mould, or which may mitigate against the achievement of maximum soundness. Such collaboration is important with gravity-die-castings. Control of quality might be said to begin with the "vetting" of the customers' designs.

Nickel-alloy Sand Castings, Quality Control

By D. R. Wood, M.A., and J. F. Gregg, B.Sc.

Nickel-alloy sand castings were dealt with by D. R. Wood, M.A. and J. F. Gregg, B.SC. In this contribution an account is given of the effects of small variations in composition on the mechanical properties of alloys of nickel with carbon, silicon, copper, chromium, molybdenum, tungsten, and tin, and containing also iron and manganese. Small contents of sulphur and lead are shown to be deleterious. Their effects are less pronounced in nickel/chromium than in nickel/copper alloys. Some data are given on the factors affecting welding properties and castability. The choice of melting furnaces, refractory linings, and raw materials is discussed. Descriptions are given of melting procedures for electric-induction and -arc furnaces, including the use of "boiling" and oxygen lancing for degasing and refining and reference is made to melting in other types of furnace.

Metal-preparation Techniques

It is shown that, by oxygen lancing molten nickel/copper and nickel/chromium/iron alloys, a high level of mechanical properties is obtained from scrap-metal charges, and that the weldability of the nickel/copper alloys is also improved. Techniques of alloying, deoxidation and sulphur control are described. The high melting-point and the high liquid- and solid-contraction of nickel-base alloys, combined with their relatively low strength at temperatures immediately below the solidus, are shown to call for the use of highly-refractory moulding sands, substantial feeder systems and mould designs permitting unhindered contraction of the metal, in both the liquid and the solid state. Variations in carbon content, silicon content and effects of sulphur and lead are discussed and their effect on the structure and properties of nickel alloys, and the casting properties of these alloys (with the exception of graphitic nickel) are shown.

Factors which affect good melting practice are enumerated and briefly, the following are the main points contained in the paper on this subject: The furnaces must be capable of melting the charge of metal in a reasonably short time, and give pouring temperatures in the range of 1,450 to 1,600 deg. C. Porosity due to hydrogen can occur in all the nickel alloys, and nitrogen has a similar effect in the alloys containing chromium. Methods of control are threefold, *viz.*, to minimize the gas content of the molten alloy, to add small amounts of elements having sufficient affinity for these gases to prevent their release on cooling and solidification, and to avoid introducing gas during casting. Time and temperature are two major factors affecting reactions occurring during melting, and quality during melting is dependent upon strict control of these variables. In general, high melt-temperatures should be avoided, *e.g.*, an increase in temperature of 100 deg. C. will approximately double the oxygen solubility. Each stage of the melting cycle, from charging to pouring, should be accomplished in the shortest possible time, unless some specific objective, such as removal of sulphur by slag treatment, has to be achieved.

Melting Equipment

Raw materials, other than returned scrap, normally used for manufacturing nickel-alloy castings, are listed in the paper, together with some details of their general composition and impurity contents. On the subject of choice of melting furnace and refractory linings, the authors state: "Coreless induction and direct-arc furnaces are widely employed for melting nickel alloys for sand castings. In these furnaces, acid linings are often used, but linings based on magnesia are the most generally satisfactory. Acid linings have the advantage of cheapness, ease of installation, and resistance to thermal shock, but basic linings are to be favoured because of their intrinsic capacity to remove sulphur, and their stability towards fluid basic slags which may be necessary to assist in desulphurization. It is also possible in basic linings to use high melting and pouring temperatures without risk of serious contamination of the melt. In general, small arc-furnaces are most conveniently-heated by the indirect process, whereas direct-arc heating is favoured for larger furnaces; the borderline lies at approximately 500-lb furnace capacity. Special melting procedures, for example, those involving the use of basic slags or oxygen lancing, are best carried out in relatively-large furnaces. Small furnaces are normally used only for simple remelting operations.

"In arc-melting, it is desirable to minimize contamination of the melt with gases by operating with short arcs, which are associated with relatively low arc voltages, particularly during the melting-down period. A small and decreasing proportion of the nickel-alloy sand castings produced is melted

in plumbago crucibles, in coke-, gas-, or oil-fired furnaces, and under these conditions an additional source of contamination arises from access of sulphur-containing products of combustion. Serious contamination from sulphur is avoided by using a fuel of consistently low sulphur content, say, less than 0.5 per cent., by keeping the melting time short, and by maintaining an oxidizing flame." Next, the authors describe melting procedures for electric-induction and arc furnaces and include the use of "boiling" and oxygen lancing for degassing and refining. Reference is also made to melting in other types of furnace.

Moulding and Casting

The final part of the paper deals with moulding and casting and includes an example of running and feeding techniques used successfully for Monel. High-quality castings in this metal are made in dry-sand moulds formed from washed silica sands, graded to give high permeability and bonded to secure the required properties for castings for pressure-tight applications. For less-exacting purposes, the authors give the following composition for the facing sand: fine silica sand (washed) 58, coarse silica sand (washed) 30, coal-dust 3.5, bentonite 3.0, core gum 0.5, and water 5.0 per cent. Mould dressings are very varied but the authors suggest a coating consisting of dry, powdered plumbago, rubbed on to the mould surface, or a fine refractory sand such as silica or zircon flour, which can, for example, be applied as an aqueous suspension. A guide to optimum pouring temperatures for high-nickel alloys is given. Finally, a short section deals with inspection and test-bars.

Quality of Pressure Die-castings

By H. J. Sharp, M.Sc.

The Author of the Paper on pressure-die-casting, H. J. Sharp, M.Sc., discusses measures that can be taken during the production of pressure-die-castings to ensure the attainment of a high standard of quality. The aspects covered include selection of suitable machines, alloy selection, detection and elimination of defects, control of metal quality, casting and die design, maintenance of a suitable heat balance in the die cavity, control of metal flow into the die, and the effects of injection pressure. The interaction of these variables with one another is considered.

Machines

The Author describes three types of die-casting machines. In the first example, the metal to be cast is held in a closed crucible provided with a submerged outlet like that of a kettle. Air pressure exerted above the surface of the molten alloy forces it directly into the die—this is known as the "air-operated goose-neck machine." In a second type, the "piston-operated goose-neck machine," displacement is effected by means of an air-operated, submerged piston and cylinder. Both these types are "hot-chamber machines," the metal being completely fluid until it enters the die. In the third type, the molten alloy is ladled from a holding furnace into an injection cylinder, and then forced into the die by means of a piston—this forming the basic principle of the cold-chamber machine. The Author states that these fundamental differences in design must be borne in mind if full advantage is to be taken of the merits of a particular machine. He continues—"The piston-operated goose-neck machine is ideal for castings in zinc-base alloys, as high operating speeds can be maintained. For brass die-casting, however, a vertical-injection cold-chamber machine is invariably used, because this gives the minimum of chilling. Similarly, magnesium alloys, which have a low heat content, need high injection speeds with a minimum of chilling before injection. The ideal machine for magnesium is a piston-operated goose-neck type. In the case of aluminium alloys, particularly when heavy sections have to be cast with a high degree of soundness, a horizontal-injection cold-chamber machine is preferred, capable of exerting a very high injection pressure."

The main types of defects which arise in pressure-die-casting are next enumerated and methods given to overcome or eliminate the occurrence of these. There is a section of the paper devoted to alloys for pressure-die-casting including aluminium-, magnesium- and zinc-base alloys and available methods for checking each alloy are given together with the composition requirements.

Control Factors

The Author next discusses the design of the casting and the die and lists the following factors which should be noted as having a direct bearing on the subsequent control of casting quality when cold-chamber machines are used: (1) The injection stroke of the machine is constant; consequently the larger the volume of metal used per shot, the larger should be the diameter of the injection sleeve. Moreover, the shorter the stroke of the injection ram, the better it is from the point of view of reducing metal chilling. (2) The larger the volume of metal used per shot, the less will be the variation in temperature of the injected metal due to differences in the operator's times of ladling and pouring into the injection sleeve. (3) The larger the sleeve diameter and the more completely it is filled by metal before injection begins, the less will be the volume of air injected into the die. Factors (1) and (2) have a considerable influence on the occurrence of "misruns" and "cold shuts," while factor (3) affects the amount of air entrapped in the casting. The question of heat balance in the die cavity, metal flow into the cavity and injection pressures are afterwards considered, followed by process variables and their control. Final sections of the paper deal with production running of the die and inspection procedure.

Non-destructive Control Methods

By S. L. Fry

The final paper of this symposium is one presented by S. L. Fry. After brief reference has been made to methods such as visual inspection, liquid penetration, pressure testing, ultrasonic testing and fluoroscopy, the main part of the paper is devoted to a discussion of the radiographic examination of castings, and to the interpretation of the results.

The Author deals very briefly with the first-mentioned methods of testing and concentrates on radiographic inspection, using X-rays and gamma-ray sources, which he suggests is the method capable of giving the greatest range of information. The possible use of certain radioactive isotopes as sources of radiation is discussed but it is pointed out initially that while these are not greatly used for light alloys yet, their advent has greatly increased the scope of the work. A list is given of the main isotopes available, their source, power equivalent to X-rays, their half-life and penetration thickness. The method of taking a radiograph with an isotope is given. Factors affecting the quality of radiographs are included and the practical application of these factors are described particularly relating to the use of screens and filters. Defects revealed by radiography are listed as shrinkage, gas-porosity in aluminium alloys, oxide inclusions and blows, cracks, sealed shrinkage or tears, and dense inclusions. The Author describes the method of using the results obtained by radiography by means of the keeping of records and the making of reports.

The Statements included at the end of the paper include the belief that "There is every indication that in the future, castings will be called upon to perform even more arduous duties. To assist this development, non-destructive testing methods will have to progress, though even at present very few defects escape detection when a casting is subjected to comprehensive examination. With the reduction of costs which is bound to come, castings previously left unexamined, for economic reasons, will be dealt with. Hope is expressed that a substantial development will take place in the not-too-distant future in the field of ultrasonic testing, since this method holds the greatest promise of increased speed and reduced cost. In fluoroscopy, the image intensifier—a recent development by which the brightness of the image on the screen can be greatly increased—should make it possible to examine all but the most critical work by screening only."

DISCUSSION

The discussion was opened under the chairmanship of Dr. L. B. Pfeil of the Mond Nickel Company, Limited, by MR. FRANK HUDSON, speaking on behalf of the Institute of British Foundrymen. His criticism, he said, was mainly one of omissions in regard to the influence of design, particularly on the properties of castings. He strongly supported Mr. Sharp in his views on design of die-castings and said that at all times the manufacture of specialized castings demanded assessment of the actual properties to be found in the different parts of the castings, adding that the founder's job is to sell castings and not test-bars. Saying there was a need for gauging the effect of section changes particularly on long-freezing-range metals, he stressed the value of stepped test-bar castings and quoted results for 85/5/5/5 and 88/10/2 gunmetals where, in the former, there was a reduction of from 16 tons per sq. in. in the 1-in. step to 7.8 tons in the 4-in. step and in the latter, from 20.3 to 14.9. The 50 per cent. decrease in the first case he attributed to the impossibility of feeding the 85/5/5/5 alloy in really heavy sections; the 88/10/2 he described as self feeding and thus better in its lack of sensitivity to section change. Mr. Hudson's views were shared by the next speaker who also stressed the lack of information on the properties of castings and the effect of section thickness. DR. V. KONDIC then took the "offensive," asking (*a*) why the symposium excluded consideration of mould factors and (*b*) why thermodynamics were also avoided. Asking the question: "How does metal flow?," he said the fluidity spiral is virtually useless as a practical test for foundry application. He also grumbled that there were no real data on heat transfer and on volume changes during feeding. Ransley's gas-estimation apparatus he described as one of the most promising developments so far for aluminium alloys. Referring to grain-size, he thought that the control achieved was not the result of nucleation. Also on this subject, he said information was lacking on why and when to grain refine and which phase to select; why were there not available standards of grain-size for reference purposes? Finally, on the subject of test-bars, he thought it was high time foundrymen and metallurgists arranged closer co-operation.

Comment on Fluidity

MR. A. V. CARLESS replied to the effect that (*a*) fluidity depends on the degree of modification of alloys and (*b*) proprietary grain-refiners would alter the fluidity and feeding characteristics of some special alloys independent on their influence on grain-size. He himself favoured the British Non-Ferrous Metals Research Association's form of the reduced-pressure test for checking gas-content of alloys as he felt that Ransley's apparatus needed further development before it could be considered a real foundry tool. MR. CIBULA, referring to fluidity, said this property involved surface properties and really a special test was required to evaluate it. DR. E. SCHEUER emphasized what Mr. Hudson had said and dealt with the idea of deliberately gassing metal for casting, so as to overcome some of the shrinkage problems—using possibly the metal/mould reaction for this purpose. He said it was possible to bubble pure hydrogen through a melt and estimate the rate of gas pick-up by measuring the amount of gas lost during bubbling. A convenient rate of passing the gas was one or two litres per minute. He illustrated

this idea with a number of slides showing the apparatus, the reproducibility of results and some of actual effects on shrinkage.

Position with Magnesium Alloys

DR. E. F. EMLEY, of Magnesium Elektron, Limited, stressed the value of fracture tests for magnesium alloys and showed slides of typical fractures. He also drew attention to the value of such a rapid instrument as the Quantometer for checking the composition of a metal before pouring. He then dealt with Dr. Kondic's comments point by point, saying in effect that in the magnesium field at least considerable work was being done in the matters Dr. Kondic thought were being neglected, although results had not yet in all cases been sufficiently positive to justify publication. The next speaker was concerned with the relation between testing methods and the evaluation of serviceability of castings and said that, for instance, aluminium castings were being used in fatigue and yet very little information was available as to their behaviour under such conditions. MR. N. GRAM from Copenhagen referred to temperature measurement and said that although immersion thermocouples were undoubtedly best, many foundries still relied on optical assessment. As an example of an error which could result from optical temperature measurement, he instanced the effect of sulphur on zinc-containing alloys which made them appear hotter than they really were. Discussing wear-resistance, he said the beneficial effect of phosphorus was not confined to bronzes but could also be applied to brasses, though it did make them more difficult to cast.

DR. R. KING (I.C.I. Metals Division) who described himself as mainly concerned with cast slabs and extrusion billets, referred to the statistics of MR. MARTIN'S paper and agreed that composition was the most important element in routine control, showing slides of composition distribution of various alloys. The mean composition was not always the most economical to produce and he quoted the application of statistical analysis using the area under the distribution-curve to compute the optimum economical metal composition to aim at. MR. G. B. EVANS of De Havilland Aircraft Company, Limited, added his thanks to the authors for excellent papers and asked what could be done with L.33 alloy in regard to grain-size, using slides of defective castings in this material to make his points clear. In his firm despite full radiography, such scrap castings were found at the rate of 250 per month plus a further 150 requiring rectification out of a total of 11,000 per month handled. The defects were mainly found by penetrant methods which he described as much cheaper to apply than radiography, which latter process might itself cost from 30 to 50 per cent. of the cost of a casting. Chromic-acid anodizing was a specially valuable penetrant method. He also showed examples of Class-III-inspection casting defects and asked for more attention to be paid to "proved" quality in castings, especially for more emphasis to be placed on checking first batches.

Controversial Matters

MR. A. R. MARTIN took up a number of points made by various speakers. *Inter alia*, he said that the fracture test can often be a necessary supplement to radiography, instancing the aluminium/10 per cent. magnesium alloy where porosity showed up very dark in the fracture after heat-treatment. Lack of anodizing control could be harmful to a casting, but often anodizing did indicate the position of defects. He agreed there was room for an investigation of the effect of grain-refiners on 5 per cent. silicon/aluminium alloys but disagreed with Mr. Hudson as to the importance of discrepancies between test-bars and castings. Often, he said, the beneficial effect of degassing was very small. He thought segregation in a sample was often an overriding factor in assessing the value of the results obtained by spectrographic analysis, with such instruments as the Quantometer. MR. A. L. PENDREY of John Dale, Limited, disagreed with this view, and said that direct-reading spectroscopy would give the desired results. He, too, mentioned the gap between the Institute of British Foundrymen and the Institute of Metals in considering matters arising in non-ferrous foundry practice and especially in the field of training of personnel, where he thought the IBF should pay more attention to the training of semi-skilled operators.

MR. P. A. FISHER of Magnesium Elektron, Limited, reiterated that what Mr. Hudson said was desirable was in fact done for magnesium casting alloys, but agreed that the methods of assessing the strength of castings were open to question. Special shapes of test castings would be valuable to assess the founding properties of the alloys. It was necessary to relate metallurgical quality and the shape of a casting and the real influence of defects; in specifications, an attempt should be made to guide users as to what percentage of a test-bar result they could expect in a casting. Thus, it would be valuable if more case-histories of castings and related test-pieces could be made available from users of alloys. MR. WOOD of the Mond Nickel Company, Limited, referring to the query of Dr. Kondic's as to why grain refining should be carried out, said some cases supporting the value of grain refinement were clear-cut but others needed more data and he quoted examples of grain size *versus* section thickness for the 85/5/5/5 and 87/6/5/2 gunmetals, relating their properties and density also.

MR. A. R. FRENCH of J. Stone & Company (Charlton), Limited, explained that the terms of reference for the present papers had specifically excluded consideration of the strength of castings and this explained why the authors had not entered into this field. Following this, DR. KONDIC elaborated his ideas on fluidity and grain size of non-ferrous alloys and afterwards the meeting adjourned for luncheon. After lunch the chair was taken by Mr. H. J. V. Williams, then president of the Institute of British Foundrymen.

Afternoon Session

Opening the discussion in the afternoon, DR. W. M. DOYLE (High Duty Alloys, Limited), suggested that the paper by Mr. Ruddle and Mr. Cibula was so good that it should be re-written in terms more suitable for practical foundrymen who could use it, in effect, as their "bible." After commenting on several of the papers he referred to his own practice of using cast-on ¼-in. dia. pencils as spectroscope electrodes for analysis. In this way, and using a direct-reading attachment to the spectrometer, he could ascertain a complete analysis of light-metal alloys in three minutes, and apply it for foundry control. There was a danger of hydrogen pick-up from addition salts, he considered. Another view he expressed was that Dr. Ransley's Telegas equipment should be used in conjunction with the reduced-pressure test as at present he had found no direct correlation—no doubt this was a matter which would be "ironed out." He commended the statements given in paragraphs 3 and 4, section 10, of the paper by Emley and Fisher, dealing with the organization of production to facilitate quality control, but said that sometimes despite what was otherwise desirable hard economics must rule. He deprecated the fact that no mention was made of lubricants in pressure-die-casting because he had found it necessary to vary these according to the metal being cast. He thought Mr. Fry was wrong when he said that gas porosity did not significantly reduce mechanical properties and would have liked some figures quoted for the permissible levels of defects.

Final Comments

MR. CIBULA, replying to the query as to whether grain-refinement was worth while, said it depended much on the alloy being cast. MR. MARTIN said his views were those of a practical man and not of a research worker, he had described how he organized the collection of data and he definitely applied in his foundry the information secured in this way. MR. SHARP, replying to one of the points made by Dr. Doyle, said when die-casting LM 6 alloy, he found no necessity for modification, though he agreed he was mainly casting thin sections—there was always difficulty in modification of metal in a holding furnace. MR. L. A. J. LODDER, of Imperial Smelting Corporation, discussing zinc-alloy die-castings, said the mechanization conferred by the die-casting process did lend itself to the imposition of a high degree of control. Analysis techniques adopted for zinc-base alloys were not difficult spectrographically, and he referred briefly to the BSI "Kite" certification-scheme for these alloys, which was proving a boon to the smaller die-casting firms. Concluding his remarks, he said the design of pressure-die-castings was to some extent covered by a generally observed code of practice and added a brief reference to the "steam test" for eliminating "very-bad metal" which had now been largely dispensed with. MR. DUCKWORTH, of Glacier Metal Company, Limited, endorsed Mr. Martin's remarks of the practical usefulness of statistical methods.

MR. ELLIOT, of the Aluminium Development Association, disagreed with Mr. Sharp, regarding the feasibility of anodizing the 5 per cent. Mg/aluminium alloy (though Mr. Sharp interjected the remark that this process could, with difficulty, be applied to the alloy in question). Mr. Elliot added that an American modification process could be applied to the LM 4 alloy. MR. WILKINSON, of Magnesium Elektron, Limited, congratulated Mr. Sharp on his successful production die-casting of magnesium alloys and on the quality secured and, shortly afterwards, the discussion terminated.

BCIRA Exhibition

An exhibition with the theme "Science in Iron-founding," which has been organized by the British Cast Iron Research Association in conjunction with the Birmingham Exchange and Engineering Centre, is currently being held in the Exhibition Hall of the Engineering Centre, Stephenson Place, Birmingham, 2, and will be open until August 30, on Mondays to Fridays, from 9 a.m. to 5 p.m., and on Saturdays between 9 a.m. and noon; there is no charge for admission.

Among the exhibits there are displays illustrating the relationship between the structure and properties of grey cast-irons; the corrosion resistance of various unalloyed and high-alloyed cast-irons in the presence of different types of corrosion conditions; a sand-mould assembly showing the components and materials used to produce a specimen casting; the principal requirements for meeting wear resistance; the weakening of grey-iron castings due to the presence of very small quantities of lead and tellurium in the raw materials; typical foundry layouts; and methods of controlling dust in foundry processes. The advisory, information, and library services, and the higher foundry education and apprentice schemes are also represented.

Iron-ore Imports

Iron-ore imports in June, and the totals for the first six months of this year and last, are shown below.

From	Month ended June 30.	Six months ended June 30.	
	1957.	1956.	1957.
	Tons.	Tons.	Tons.
Sierra Leone	57,380	360,480	360,959
Canada	396,509	638,603	682,872
Other Commonwealth countries and Eire	108	10,001	7,805
Sweden	375,449	2,016,970	1,812,174
Norway	17,730	42,782	111,980
Western Germany	—	3,008	17
France	34,419	325,786	308,482
Portugal	16,985	67,743	71,515
Spain	69,033	453,681	507,141
Algeria	110,635	751,386	738,920
French West Africa	70,148	356,591	337,955
Tunisia	89,535	389,224	411,909
Northern Morocco	25,305	149,161	122,562
Southern Morocco	27,523	221,301	173,842
Liberia	38,540	176,648	201,647
Brazil	66,056	273,726	332,255
Other foreign countries	92,698	295,696	601,175
TOTAL	1,488,053	6,532,787	6,783,210

Notes from the Branches

South Africa

A record number of 170 members and guests attended the 1957 annual dinner of the South African branch of the Institute of British Foundrymen, held at the Grand National Hotel, Johannesburg, on June 21.

Election of Officers and Awards

During the dinner, the following branch appointments were announced for the year 1957/58: Mr. S. Pienaar, president; Mr. K. H. Coombs, senior vice-president; Mr. N. Croft, junior vice-president; hon. treasurer, Mr. S. Jane, and hon. secretary, Mr. J. Steele. Mr. R. C. Cross and Mr. A. A. Guest were re-elected to the branch Council and Mr. J. H. Peers and Mr. V. F. Williams were elected to fill two vacancies on that body. The fourth A. H. Guy medal to be awarded since its foundation in 1949 was presented by Mr. J. A. de Kiewet (past-president) to Mr. J. Steele for meritorious service to the branch. The award for a paper by a non-member was presented to Dr. L. B. Knoll by Mr. H. A. Godwin, for his paper entitled "What the Engineer expects from a Casting," and Mr. J. J. Marais received the award for the best paper by a member from Mr. H. Holdsworth, for his entry entitled "Silica, its Properties with Relation to Foundry Sands."

Other Matters

The retiring president, Mr. G. F. Alexander, in his valedictory address referred to the branch Council's proposal to establish a Foundry Sands Research Fellowship of the Council for Scientific and Industrial Research, on the basis that the Council would make available scientific equipment (to the value of approximately £10,000), laboratory facilities, and undertake the direction of the research if sponsors could be found to put up a sum of £1,750 per annum for three years. This sum would cover the salary and expenses of a university graduate suitable for appointment to the Fellowship. In response to a branch circular, requesting support for this investigation into the availability and suitability of South African sands for foundry practice, the sum of £739 had already been promised by 12 sponsors.

In presenting Mr. Alexander with his presidential certificate and congratulating him on a most successful year of office, Mr. Pienaar announced the donation of a capital sum by Mr. Alexander for the establishment of the G. F. Alexander prize to be awarded annually as a result of the branch Short Paper Competitions. Mr. Pienaar then gave his presidential address, during the course of which he said that, particularly since the war years, the South African foundry industry had made rapid strides and to-day it could virtually cope with all the country's needs for ferrous and non-ferrous castings, for mining and agricultural machinery and domestic use; and last, but not least, for the railways, which were to-day probably the biggest single consumer of mass-produced castings for their vast development scheme. The president concluded his address by advising foundrymen to apply scientific principles to the manufacture of their products and establish sound costing systems. Mr. J. Tonge and Mr. D. Lion-Cachet (past-presidents) and Dr. W. Bleloch also addressed the meeting.

AN EFFICIENT WAY to dry coresand is to attach a rectangular hopper with a slit opening at the base to the wall of a not-too-well-insulated furnace.

Falkirk Firm's Diamond Jubilee

Glover & Main group's Gothic Works of R. & A. Main, Limited, Camelon, near Falkirk, celebrated their diamond jubilee on July 14. Formed in 1897 on the merging of Thomas Glover & Company, Limited, and R. & A. Main, Limited, Glover & Main, Limited, have literally grown up with the gas industry and, through the two original companies, has associations which go back to very early days. Thomas Glover & Company, Limited, started the manufacture of gas meters in 1844, and by the date of the amalgamation had established a solid reputation both as pioneers and for quality and craftsmanship in the gas-meter industry.

Milestones in Glovers' development up to the time of the merger, include the successful introduction of the first dry meter in 1844, using a system of slide valves devised by Thomas Glover himself. Then in 1894, the introduction and patenting of the first *in situ* price-charging device for prepayment meters. Even in the modern dry meter of to-day these basic principles are still retained. In those far-off days Glovers were always credited with the lasting ability of their goods. The original No. 1 Glover dry meter sold to a Coventry firm in 1844, was repurchased by the firm the year before the amalgamation still in perfect working order after 52 years of continuous service. It can still be seen at the Gothic Works, Edmonton, where it is kept in honourable retirement. Another highlight was the installation of 3,000 light meters—the largest meter of its day—at the Great Exhibition of 1851. At this same exhibition the prize medal and certificate of merit signed by the Prince Consort were awarded to Thomas Glover for a gas meter exhibited by him.

New Partnership

R. & A. Main Limited, started from humble beginnings in the 70's of the last century, being founded in Glasgow as the Argyle Ironmongery Company. When the amalgamation took place it also brought to the new partnership a reputation as pioneers. The Argyle Ironmongery Company of Glasgow made cooking appliances for hotels and the like. A restaurateur, Matthew Waddell, interested himself in this matter and with Robert B. Main, an ironfounders' representative, formed the firm of Waddell & Main. They made restaurant and domestic gas-cookers and the partnership flourished. However, about 1884, Waddell reverted entirely to catering and R. B. Main took into partnership his brother, A. P. Main, and the firm became R. & A. Main, Limited. Many objections were raised by various interests against the use of gas for cooking and Mains were responsible for settling the matter by referring it to a well-known Edinburgh authority, Dr. Stevenson Macadam. He stated: "The wholesomeness of meat cooked in gas ovens must be regarded as beyond doubt." This reassurance marked the turning point in the gas-appliance industry. From that date the demand, not only for cookers but for all types of gas appliances, rapidly increased and Mains with their progressive designs and quality products were quickly established among the leading manufacturers.

Slag from Shotton Furnaces

Construction of plant to make road materials from slag from the Shotton blast-furnaces is the intention behind the formation of Shotton Slag, Limited. The initial capital is £100,000, but further finance is to be provided by Derbyshire Stone, Limited, and Tarmac, Limited, which will hold the shares equally.

Tees-side Foundry Competition

The 1957 apprentice competition organized by the Tees-side branch of the Institute of British Foundrymen again proved to be one of the most successful and stimulating events of this session's activities, and attracted a record entry (Table I) of 147 from 23 different foundries. In a new section, introduced

FIG. 1.—*Views of the judging of the annual apprentice competition, organized by the Tees-side branch of the Institute of British Foundrymen. (a) Mr. Ben Buxton (left) of Stockton Castings, Limited, and Mr. R. L. Simpson, general manager of Modern Foundries, Limited, of Halifax. (b) Judging the wood and metal-patternmaking section are (left to right) Mr. L. Brown, managing director, Premo Pattern Company, Limited; Mr. H. Wilson, John Vickers & Sons, Limited; Tom Hurst, apprentice-competition secretary, and Mr. John Vickers, competition chairman. (c) Examining the steel-castings entries are (left to right) Mr. R. Wright, English Steel Castings Corporation; Dr. Cyril Dadswell, managing director of English Steel Castings Corporation, and Mr. D. Forster, of Darlington Forge, Limited. (d) Mr. Alan Riley (left), Tees-side branch president (1956 to 1957), and Mr. C. A. Timms, director British Engines, Limited, of Newcastle-on-Tyne, examining one of the non-ferrous casting entries.*

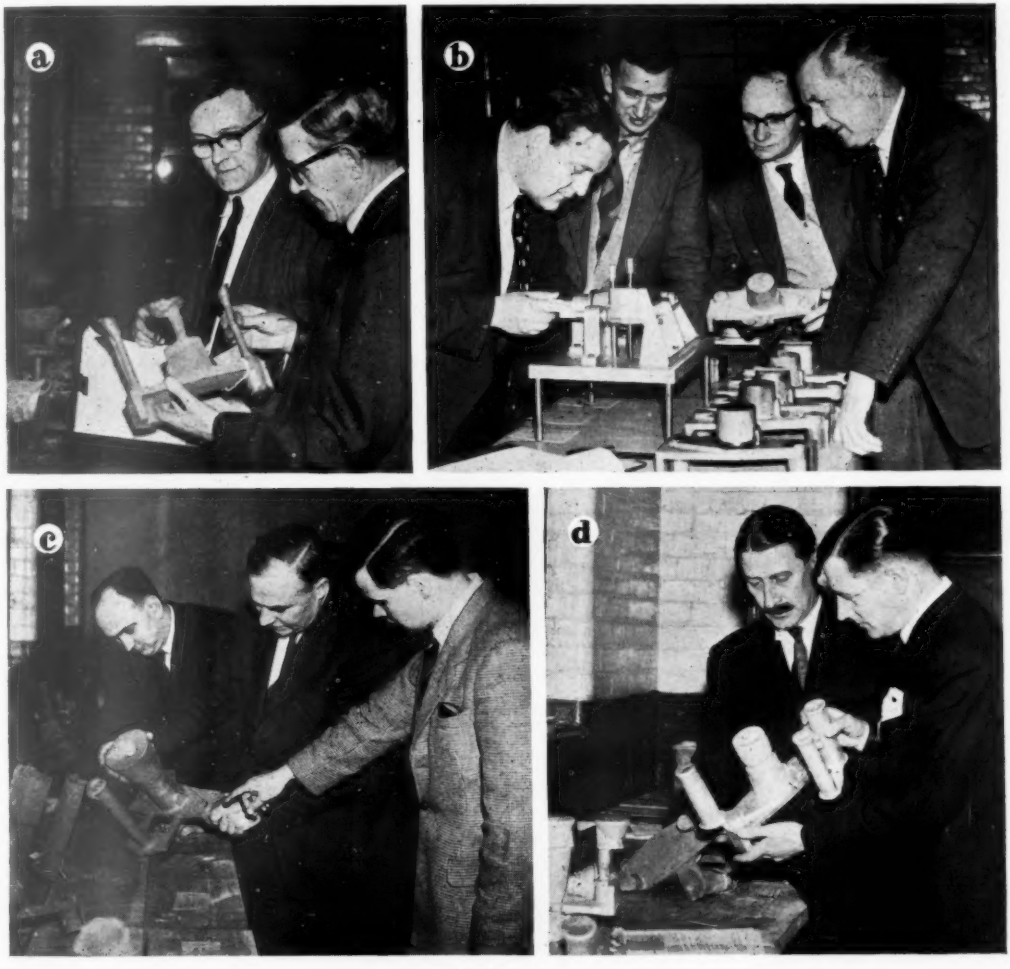


FIG. 2.—*Mr. Tom Everett, managing director of Richardson Westgarth & Company, Limited, presenting the first prize to Paul Gibson of John Vickers & Sons, Limited, for his entry in the metal patternmaking section of the competition. With Mr. Everett, on the platform, are (left) Mr. Frank Shepherd, Tees-side branch secretary and Mr. Tom Hurst, secretary to the competition.*

this year for metal patternmaking, to stimulate interest in this increasingly important aspect of foundry crafts, the test-piece selected by the Competition Committee was identical to that used in the American National Apprentice Competition last year.

TABLE I.—*Entries for the Past Four Years' Competitions.*

	1954.	1955.	1956.	1957.
Number of entries	119	127	140	147
Number of firms	25	22	21	23
Number of prizewinning firms	12	11	10	10

Table I indicates the increasing interest shown in these competitions over the past four successive years, and it is worthy of note that entries are received in areas from Hartlepool, Redcar and Loftus in the east, to Barnard Castle, Wolsingham and Bishop Auckland in the west.

Judging was again carried out by the panel of distinguished foundrymen, listed in Table II, who travelled, from various parts of the country, to the works of Darlington Forge, Limited, where the competitors' efforts in the craft-sections were arranged for judging in the apprentice training school.

Photographs of the judging are shown in Fig 1; the judging of the wood patternmaking in Fig. 1 (*b*), being of particular interest, clearly showing the special "receiver jig," produced for the competition by Ashmore Benson, Limited, for checking dimensional accuracy of the patterns, this playing an obviously important part in the judges' assessment. Prizes were presented to the winning entrants at the annual general meeting of The Tees-side branch, by Mr. Tom Everett (Fig. 2), managing director of Richardson Westgarth & Company, Limited, of Hartlepool. Here again, the branch was fortunate in having the unstinted support of Head, Wrightson, Limited, who not only allowed the use of their excellent meeting accommodation, but arranged for all the craft section competition-pieces to be on exhibition.

Mr. Everett, addressing a packed audience of members, apprentices, their parents and friends, stressed the importance of the necessity for active encouragement and support, from parents, for the successful training of apprentices at work.

TABLE II.—*Panel of Judges for the Various Sections.*

Section.	Judge.	Status.
Steel castings	Dr. Cyril Dadswell	Managing director, English Steel Castings Corporation (Sheffield).
Iron castings	Mr. R. L. Simpson	General manager, Modern Foundries, Limited (Halifax).
Non-ferrous castings	Mr. C. Timms ..	Director, British Engines, Limited (Newcastle-on-Tyne).
Wood and metal patternmaking	Mr. L. Brown ..	Managing director, Premo Patterns, Limited (Birmingham).
Written-paper competition	Mr. J. Currie ..	Director, Blackett Hutton, Limited (Guisborough).

Prizewinners

Steel Moulders: 1st—M. Pincher (Wilsons Forge, Limited, Bishop Auckland); 2nd—B. G. Broadbent (Head, Wrightson, Limited, Thornaby); 3rd—K. Gretton (Davy & United, Limited, Middlesbrough), and 4th—C. Gilbey (Wilsons Forge, Limited).

Cast Iron: 1st—R. G. Appleyard (Head, Wrightson, Limited, Stockton); 2nd—P. Hunter (Ashmore Benson Pease & Company Limited, Stockton); 3rd—J. Sayers (Wilsons Forge, Limited), and 4th—C. Thomas (Stockton Castings Company, Limited, Stockton).

Non-ferrous Moulding: 1st—R. J. Garnett (Daralum Castings, Limited, Darlington), and 2nd—A. F. Currie (Daralum Castings Limited).

Wood Patternmaking: 1st—K. Lees (John Vickers & Sons, Limited, Darlington); 2nd—M. Harrison

(*Concluded at the foot of col. 2, page 167.*

Founding Industry in Dundee

Generally speaking, ferrous and non-ferrous foundries in Dundee and district are at present said to be working to full capacity. In recent years, the basis of local industry in Dundee and the north-east of Scotland has been greatly broadened with the result that, apart from textile machinery, there is now a demand for machine-tool castings, as well as for castings of a wide range for food-processing industries. The following report on foundries in the area and prospects of trade has been submitted by a correspondent in that area.

Wallaces, Limited

The foundry of Wallaces, Limited, which is a converted textile factory, has a capacity in ferrous and non-ferrous iron castings ranging from a few pounds to 30 tons, and production is devoted to machine-tool castings, mainly for engineering firms in north-west England. A job recently undertaken was the manufacture of a slaughter table for Craven's machine-tool production programme, involving a casting weighing about 20 tons. Uprights, bends, and cross-pieces are also manufactured for turning and boring mills for engineering firms in Scotland and the North of England. The foundry is having little or no difficulty in engaging labour, in fact from experience of late there appears to be a surplus of foundry labour in the district.

David Boswell, Limited

Much of the production of David Boswell, Limited, Tayside Brassworks, Dundee, is for the marine-engineering industry, the company specializing in valves and cocks for marine boilers. The labour position is reported to be satisfactory, there being full employment and no very great turnover. The enrolment of suitable apprentices is presenting no difficulty and the day-release scheme in operation is working well.

Robert Kellie & Sons, Limited

The Dundee foundry of Robert Kellie & Sons, Limited, is mainly employed in providing castings for the firm's own products; these include a comprehensive range of jam-making, confectionery and canning machinery. It is claimed that almost every jam manufacturer in Britain is using some machinery made by the firm, and orders for their food-processing machinery come from all parts of the world, including the dollar area. Castings are produced by the company in iron, brass, gunmetal and aluminium. The labour position here is reported to be fairly stable, with full employment. A day-release scheme for apprentices is in full operation, with apprentice moulders attending their trade class in their first and second year of apprenticeship. Rising transport costs are said to be causing some concern here; this is a serious matter for Dundee firms as they are placed some distance from the main markets in Britain.

Lawside Engineering & Foundry Company, Limited

Textile machinery is the main production of the Lawside Engineering & Foundry Company, Limited, their machinery going to all parts of the world excepting Europe. Increased orders have recently been received from Pakistan, Malaya and S. America. This firm finds that skilled engineers are in short supply, as are also good moulders; although they have a sufficient number of the latter to keep going they could employ more. In the opinion of the company, labour is leaving the local engineering and foundry industries more quickly than new labour is entering it. A day-release class system is also in operation, but difficulty is being experienced in getting apprentices, the probable reason put forward by the company being the quite usual one that youths of to-day prefer a cleaner job to that of the moulder. Increased transport costs are also causing some anxiety to this firm, especially in view of the rather long hauls needed to bring pig-iron to Dundee. At the moment the firm is busy, but in the near future it looks as if orders will have to be sought more keenly.

Training Facilities

On checking up at the Dundee Trades' College regarding the recruitment of labour in foundries, the writer found that the position was much brighter than expected. During the last session there were some 20 apprentices in both the foundry practice and pattern-making classes. These classes have now been in existence for 11 years, and the students have been very successful in passing the various grades of the City and Guilds examinations.

The classes are run for the elementary training of boys before they enter apprenticeship; the boys then come back as apprentices for the day-release and other classes in foundry practice and patternmaking, and as a result of this policy the standard is constantly improving. The equipment used is of high quality and the training staff feel confident of being able to supply the engineering and foundry industries in Dundee and district with sufficient skilled moulders and engineers to ensure their future.

Tees-side Foundry Competition

(*Continued from page 166*)

(John Vickers & Sons, Limited); 3rd—L. Brennan (Ashmore Benson Pease & Company, Limited), and 4th—P. E. Sharp (Richardson Westgarth, Limited, Hartlepool).

Metal Patternmaking: 1st—E. P. Gibson (John Vickers & Sons, Limited) and 2nd—H. Peacock (John Vickers & Sons, Limited).

Written-paper Competition: 1st—M. Harrison (John Vickers & Sons, Limited); 2nd—M. Collins (Blackett Hutton & Company, Guisborough), and 3rd—C. Towell (Cochrane's Foundry, Limited, Middlesbrough).

Judges' Comments

The judges' comments on the various sections were reported to the meeting by the chairman of the competition committee, who emphasized that the branch council and the competition committee were particularly gratified to note that, in the unanimous opinion of the judges, the standard of workmanship and effort of the apprentices showed a definite advance over previous years. For example, Mr. Lawrence Brown, in his comments on the wood-patternmaking section, said that this year the top nine competitors had marks as high as those gained by the winner in the competition in 1954.

The Council of the Tees-side branch has no hesitation in recommending adoption of this form of competition to other branches of the Institute, and offers its fullest co-operation to those interested, both at home and abroad. Branch officials who may be interested are invited to approach Mr. Alan Riley, foundry manager at the Darlington Forge, Limited, for details.

Law Cases

Goggles Not Worn

Mr. Harold Lewin, a foundry worker employed by Frederick Parker Limited, ironfounders, Cannon Street, Leicester, claimed £200 damages from his firm recently, for 30 injuries to his eyes in five years. He submitted that when he first joined the firm as a fettler, no goggles were supplied, but agreed that when he had been there a year, goggles were made available, although they did not fit properly, and admitted fine particles of metal dust. During the cross examination by Mr. J. Garrard, he admitted that at the time of one accident, in April 1956, when a piece of metal from a casting entered his right eye, he was wearing his goggles on his forehead, having momentarily taken them from over his eyes.

On another occasion, he was warned by the foreman that he would have to go home if he persisted in not wearing the goggles provided. This followed a similar warning from the factory manager only an hour earlier. During his five years as a fettler, he had had three pairs of spectacle-type goggles, all of which admitted dust. The face-mask type of goggles, with which he was eventually issued by the ambulance-room attendant, had been in common use at the factory for some years, submitted Mr. Garrard, and were of a type worn by the factory's welders.

When another fettler was called by the plaintiff, he was asked by Mr. Garrard if he had any complaints to make about the goggles, he replied, "Well, I'm still wearing them, sir." Judge Robson ruled that the plaintiff had failed to make out his case. Negligence he decided, could not be blamed on the employers, for whom he gave judgment.

Inexperience Blamed for Accident

In an action at Wellington (Salop) County Court, a foundry moulder, Archie Thomas Pitchford (58) was unsuccessful in his claim for damages from Court Works, Limited, Madeley, Judge D. Eifion Evans giving judgment for the firm with costs. Mr. Pitchford claimed that when working on the company's premises on March 22, 1955, he received a stomach injury through having to take the strain of the weight of a metal ladle, because his fellow workman acted in an unexpected way. The other workman, Henry Jones, told the court that he was strange to the job and that he took the weight of the ladle when Pitchford told him to.

The judge said that he was not satisfied that the accident was the result of negligence by the firm or by the other workman. It was suggested that it was wrong for the firm to allow a man of only one week's experience to undertake the job of assistant moulder. The judge said, however, that he did not take that view. Pitchford had been in the works 38 years, was a shop steward and would know any new faces. It would have been for him to ascertain whether the fellow workman knew what he was doing and to anticipate any lack of experience.

Widow's Action Dismissed

A Wednesbury widow lost an action at Staffordshire Assizes in which she was claiming damages suffered through the death of her husband following a works accident. She was Mrs. Catherine Latham (63), who brought the action against her husband's employers, the Patent Shaft & Axletree Company, Limited, Wednesbury.

Her husband, who was 61, died in hospital as the result of an operation for hernia. He was said to have injured himself while stepping into a ladle.

Giving judgment for the company, Mr. Justice Diplock said that Mr. E. Ryder Richardson, QC, for the plaintiff, had urged it was the employers' duty to provide a plank specially "earmarked" for use on that particular ladle to enable men to step across the gap. "It seems to me in this case this unfortunate accident is due to the plaintiff's own act in deciding to use a projecting bar in order to step over the ladle instead of taking the trouble—in the hour and a half he had to do so—of moving a short distance and finding a plank, as he had done on so many occasions and other chargehands had done," he said. "No doubt he did not think he was taking much of a risk by saving himself the trouble. I do not find there was any breach of duty on the part of the defendants which caused his death."

£16,605 for "Frightful Injuries"

Paralysed from the chest downwards, Mr. Peter Heppleston (29) was wheeled into Leeds Assize court on a stretcher trolley to give evidence in his action against the Goole Shipbuilding & Repairing Company, Limited. He was awarded £16,605 damages for injuries sustained in an accident when in the company's employ as a marine fitter.

Mr. Justice Davies, giving judgment, said that in November, 1954, Mr. Heppleston's coat was caught by a steel rod revolving at 250 revolutions a minute. The plaintiff was "whirled round and round" and suffered "frightful injuries." His legs were completely paralysed and, according to specialists, he was paralysed from the chest downwards. He had only been married a short time and there was one child.

"For the rest of his life he is going to be condemned to spend it in bed after a few hours if he attempts to sit or stand. Nothing can compensate this man and his wife for what they have lost," said the judge.

Steelworker Lost Right Hand

A Glasgow steelworker, Mr. John McCann, who lost his right hand as a result of an accident in the Parkhead Works of William Beardmore & Company, Limited, was awarded £2,407 damages in the Glasgow Court of Session where he sued his employers for £8,500.

McCann claimed that on August 24, 1954, when he was working as a slinger, an overhead crane driver lowered a heavy bar without warning and struck his right hand which had to be amputated.

The company denied that the crane driver lowered the bar suddenly, or without warning, or without giving a signal. They claimed that the plaintiff signalled to the crane driver to "lower away." The jury, presided over by Lord Cameron, found unanimously for McCann, assessed damages at £2,675, and held him 10 per cent. to blame for the accident.

Founding—A Light Industry?

Compression Joints, Limited, Tyburn Road, Erdington, who contend that hot-brass stamping and brass and gunmetal founding work come into the category of light industries, appealed on July 17 against the refusal of Sutton Coldfield Corporation to allow them to use premises on the Reddicap Trading Estate, already scheduled for this type of industry. Mr. A. T. Johnston, Deputy Borough Surveyor, said that in the view of the Corporation, foundrywork and hot stamping were not light industries. If these were left out and the firm's activities continued, no objection was likely to be made.

Heating and Ventilating a Mechanized Foundry

Equipment Installed at Sterling Metals' Nuneaton Works

A new mechanized foundry for Sterling Metals, Limited, is nearing completion at Gipsy Lane, Nuneaton, which it is claimed will be one of the most modern in the world, and is intended mainly for the production of small non-ferrous castings for the motor-car and aero industries. Designed initially for semi-automatic operation, this plant is intended to become Britain's first fully-automatic foundry. Whilst adjoining the company's existing premises at Nuneaton, the new building is more than an extension, and has been planned as a self-contained production unit. The building is 500 by 400 by 35 ft., and is constructed of fabricated concrete with a roof of corrugated-aluminium sheeting.

A total of 70 independent Plenum units have been incorporated in the heating and ventilating system (Fig. 1). Each of the units, which are all basically of the same design, comprises an air-intake duct, a heater battery, served from hot water mains, a Woods of Colchester 24-in. aerofoil axial-flow fan and outlet ducts. It was deemed necessary to break the system up into a relatively large number of sections, as the space available for heating and ventilating equipment was very restricted, being mainly confined to narrow areas located immediately under the roof valleys.

Installation

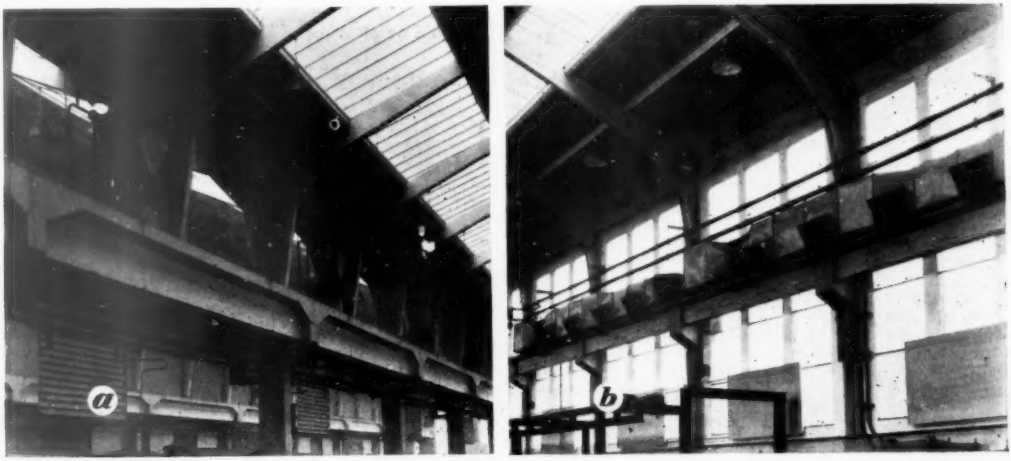
The installation is of particular interest, at the present time, as provisions of the Foundry Regulations, which recently came into force, govern for the first time amongst other requirements, proper ventilation. In recent years there has been considerable modernization in British foundry practice, especially in mechanizing the large-scale production of small- and medium-size castings.

A combined Plenum and radiant-heat system requires a temperature from 55 to 60 deg. F. for manual and semi-manual workers when the minimum outside temperature is 32 deg. F.

In their design, the heating and ventilating engineers, Richard Crittall & Company, Limited, had to take into consideration three factors: (*a*) foundry production and processing involves considerable localized heat-generation; (*b*) large quantities of fume- and dust-laden air are extracted, in the course of processing; and (*c*) the system had to be concentrated immediately beneath the roof valleys, to preserve the spaciousness of the building and the extensive natural lighting from glass panels in the roof and windows.

The system adopted, provides for an even distribution of heat, to make up for the large extraction of warm air, and counteracts any marked ingress of cold draughts. Dividing the system into small units also gave the advantage of localized control. Considerable ingenuity in design was required to keep the units within the narrow spaces under the roof valleys, since the main girders for gantry cranes were located at these points.

FIG. 1.—*Views of the heating and ventilating system incorporated at the new mechanized foundry of Sterling Metals, Limited, Nuneaton. (a) A complete Plenum unit is situated between each of the stanchions, the air intake being above the gantry rails, whilst the delivery outlet is situated immediately below the rail; radiant-heating panels can also be seen. Illustration (b) shows the location of the Plenum units on the side walls of the foundry building.*



Heating and Ventilating a Foundry

Equipment

The Woods' 24-in. aerofoil fans, in 60 of the units, are each rated to move 8,000 cub. ft. of air per min. against 0.5-in. water gauge. The remaining 10, each have a capacity of 5,000 cub. ft. per min. against 0.75-in. water gauge. These straight-through air-flow fans have high efficiency, compact design and are easily fitted in line with the duct, an important factor in this installation where the system is confined to narrow dimensional limits.

In addition to the fan and air-heater battery, each Plenum system comprises an air-intake duct, which collects atmospheric air from above the roof valleys, and approximately 30 ft. of distributing duct, extending between the main stanchions of the building. Most of the distributing ducts are fitted with five adjustable Crittall deflector outlet grilles, the air velocity at the grilles being 950 ft. per min. with a projection of about 50 ft.

The majority of the units are situated above the crane-gantry rails at a height of 12 ft. above floor level, with the distributing ducts and grilles immediately underneath. In a few cases the air discharge is arranged from above the gantry rails.

Air extraction is effected mainly by equipment fitted to the foundry plant. In order to collect and exhaust any fumes, which may escape into the foundry, 36 Woods' Series "A" roof extract-units have been installed; a further six of these units are also fitted in the roof of an adjacent building, which houses the sand-preparation plant. The roof extract-units have 18-in. dia. fans, which are rated to move 3,540 cub. ft. per min.; with this size fan the motor is mounted below the impeller, in the base of the unit, so that servicing can be effected from within the building. The cowl has a four-way outlet of high aerodynamic-efficiency, designed for minimum restriction of air flow whilst providing ample weather protection. Wind pressure, which may restrict the output of wall-mounted exhaust fans, however, is claimed to improve the performance of this unit.

New Zealand Contract for BTH

A contract, valued at £800,000, covering four further vertical hydro-electric generators for Roxburgh power station, New Zealand, has been awarded to the British Thomson-Houston Company, Limited. The machines are each rated at 44,444 kva, 40,000 kw, 11 kv, 136 r.p.m., and will be exactly similar to the four already supplied by BTH which were commissioned during the latter half of 1956. The turbines for driving the four new generators will be supplied by the Dominion Engineering Company, Limited, of Canada, which also manufactured those for the first four machines.

Roxburgh power station, with its ultimate output of 320,000 kw, will, when completed, be the largest in New Zealand, and will help considerably in satisfying the power demands of that country for the following three or four years.

ECSC Scrap Purchases

Heads of delegation of the Scrap Consumers Joint Bureau were invited to Luxembourg recently by the High Authority of the European Coal and Steel Community to draw up the text of directives which will govern commercial policy regarding community scrap purchase in the United States.

The principles on which the directives will be based are in line both with those defined by the US Government before a special committee of Congress and with those laid down in articles 3 and 4 of the treaty instituting the ECSC. They are as follow:—

Equal access without discrimination by *bona fide* scrap suppliers; purchases to be made in the most favourable conditions for community consumers on the basis of certain technical and commercial criteria which will be applicable to all offers; prohibition of all restrictive practices; the maintenance of normal competition between community scrap suppliers.

The High Authority's invitation followed the meeting of the Scrap Consumers Joint Bureau in Baden-Baden on June 28, which was attended by the director of the High Authority's market division. At this meeting, the question of community scrap purchases in the United States was discussed in the light of recent allegations before a special committee of Congress that the Joint Bureau's scrap purchases in that country were made in such a way as to give a virtual monopoly to certain companies.

Mists and Fogs from Factories

Problems of mist formation, resulting from certain industrial processes, have become more pronounced since the war and have been brought to the notice of the Department of Scientific and Industrial Research. In his annual report to the Minister of Housing and Local Government, the Chief Alkali Inspector for England and Wales says that reliable and fundamental research on the whole matter of mist formation is needed. The mass emissions concerned, he says, are usually trivial by normal standards and in most cases, but not all, are probably harmless. There is, however, appreciable and often justified complaint against the mists and fogs rolling from the works concerned.

The working hypothesis is that the mist is caused by an atmosphere of moisture around a hygroscopic nucleus. Means of treatment are often difficult and costly and if the trouble can be dealt with at its source it would be of major assistance.

Basic Materials Prices Decline

Prices of basic materials used by British Industry have declined by 3.6 per cent. in the first half of this year. The index (mid-1949=100) stood at 155.8 in June, 2.5 per cent. lower than in May and 5.8 points below last December's peak. All basic materials except fuel are included. Copper prices were 16 per cent. lower than in December and were the lowest for three years. Smaller purchases of zinc for the US stockpile have led to a fall in price of 13 per cent. since May.

The fall of 5 per cent. in tin prices would probably have been greater but for the International Tin Council's decision in March to raise its floor price from £640 to £730 per ton. Controlled prices of steel were increased by 6 per cent. on average in December and since then the wholesale price index of iron and steel has risen by only a small amount.

The overall price index for all manufactured products (other than fuel, food, and tobacco) at 138.5 in June, compared with 138.7 in May and 137.5 in December.

Costing and Estimating

One-day Study Conference Organized by the Council of Ironfoundry Associations

At the end of June, there was held in London at the Connaught Rooms, a one-day study conference on foundry costing and estimating, resulting from a report made to the Council of Ironfoundry Associations' Training Committee. The objective was to provide an opportunity for ironfounders to review their present practice in relation to the broad application of cost accounting and particularly, the methods of costing and estimating outlined in the CFA publication, "Elements of Foundry Costing"*. With an attendance of nearly 60, it was revealed that over 70 had been turned away and thus there would probably be repeat conferences† in London and the Provinces.

The conference was under the chairmanship of Mr. H. A. Bonney, F.C.I.S., managing director of Follsain-Wycliffe Foundries, Limited. The programme was conducted by Mr. W. E. Harrison, F.C.W.A., cost consultant and past president of the Institute of Cost and Works Accountants, supported by Mr. G. B. Judd, F.C.A., of Mann, Judd & Company, and Mr. H. P. Court, F.C.W.A.

In his opening remarks, Mr. Bonney said that foundrymen should take more interest in costing and the purpose of this conference was to align costing systems with technicalities of founding. Mr. Bonney said he was one of a 10-man committee of the Council of Ironfoundry Associations who, in the early 1940's, produced a framework for the CFA "Cost Ascertainment Manual". The criticism received about this book was that smaller foundries felt it was difficult to extract what was essential. Thus, the series of publications, "Elements of Foundry Costing" was prepared by Mr. H. P. Court and Mr. W. E. Harrison and the papers given at the present conference would be based largely on these. Mr. Judd, too, he added had been working for many years trying to induce some degree of uniformity of costing in foundries.

"Need for Costing"

In his paper on the above topic, Mr. Judd stressed the need for improvement in the standard of foundry costing and discussed ways in which interest in this matter could be stimulated. Opening his remarks, Mr. Judd praised the work that Mr. Court and Mr. Harrison had done. However, despite the many books available on the subject, he said that some foundries seemed to practice some calculations which could not by any stretch of imagination be designated as costing. In the United States, he had found that most foundries had a unified system of costing and hence, could compare prices, etc., with each other and all the personnel could understand what was done. Mr. Judd continued by relating the various methods he had used in attempting to introduce some form of standard costing in this country among founders, *e.g.* circulars asking the firms to quote against standard drawings. All his attempts had failed and he thought too many foundries based their quotations on those of their competitors. In some of the few figures sent in, in response to circulars he had distributed, he said that the main divergence was in "overheads," based on the percentage of direct labour applied in costing individual jobs. There was much apathy on the question of costing and he thought the reasons for this were:—(*a*) Smallness of staff and lack of competence on costing; (*b*) orders too easily obtained, and (*c*) the manager of a foundry might be a good technician but too set in his ways to assimilate new costing methods—the remedy here was to take a young man and instil the principles of costing into him and make him cost conscious early in his career. To summate, the bare essentials of ironfoundry costing were: (1) metal cost derived from weight charged and cost of ingredients; (2) direct moulding wages, applying one or two overhead rates; (3) coremaking costs on a similar basis; (4) fettling costs (which must be intelligently appraised), and (5) patternmaking costs. He suggested, next, that someone within the foundry industry with a good system of costing should volunteer some authentic figures for people to inspect and analyse.

Other Observations

Mr. Judd then enumerated the advantages which would accrue with group costing as practised in the USA. He said he had spent 18 months trying to apply the system here and, getting very meagre information, the idea had been dropped. He said that a standard system of costing might be possible in the future, but he did not think that the time was yet opportune. Engineering works with "tied" foundries usually didn't bother too much about foundry costing as they often thought that other conveniences, such as getting castings at short notice, were more important. The industry was now well served by statistics for materials and thus increases in average costs of these could be well covered—what was now needed were similar figures for labour.

Passing on to the subject of a European Free Market, Mr. Judd likened it to a "swimming pool," mainly as it affected customers of the foundry industry. The idea, he said, would take 10 years to develop, but the need for production economy in this country could not be overstressed. Costing, under some circumstances, might be equal to, or even more important than, technical research. In closing, Mr. Judd emphasized that a high

* Available, price 10s 6d., from the CFA, 14, Pall Mall, London, W.C.2.

† These have since been arranged by the CFA, one took place on Tuesday, July 23, at Manchester, the other is scheduled for September 4 to 5 at the Kingsley Hotel, London, the programmes being substantially the same as the first.

degree of accuracy and control throughout when dealing with the question of costing should be aimed at.

"Accounting Aspects"

After a break for coffee, Mr. W. E. Harrison gave his paper on accounting aspects and cost ascertainment. This, he said, was addressed mainly to foundry managements and not to accountants and was at all times related to the "Elements of Foundry Costing" booklet, to which frequent reference was made. First, he listed the classification and collection of original data and sources of information as follow: (*a*) *Accounting Records* (1) purchase analysis (which should be taken from the Purchase Journal). Here, the allocation of headings for the breakdown of the figures should be generous; (2) pay-roll analyses; (3) cash book and petty-cash-book analyses, and (4) sales analyses. This, he said, should lead to the drawing up of a Financial Control Summary, such as was illustrated in Fig. 17 of the book, say, every four-week period. In this way, anything going wrong could be picked up immediately and there would also be a most useful record of everything being handled. (*b*) *Internal Records* could be classified, as follow, into four sections:—(1) departmental material utilization, *e.g.*, checking of stocks—most easily done when these were nil or very low; (2) wages analysis, which should show what each man was actually doing and not just what he was supposed to do; (3) departmental production analysis, and (4) expenses analysis. Also, a major subsection was the compilation of monthly (or quarterly) accounts which should be made to show what had actually taken place over the past month (or quarter). Under the heading *Reasons for Departmentalization*, he said there were (*a*) variations in type of expense; (*b*) variations in production volume, and (*c*) responsibility—for "fixed" or "variable" costs. This would be useful to show managers how they were doing. Under a fourth main heading, *Standards of Measurement*, the extraction from the records of data listed previously could permit the establishment of certain "standards" for guidance in the future, particularly when estimating. Dealing briefly with *Standard Costs*, he said that even if these could not be established for individual jobs, he suggested they could be got out for established procedures. Under the heading *Interpretation of Costs*, he said a man (cost accountant) was needed in every foundry to "get across" to individuals what each departmental manager's or foreman's costs were and why they varied. If this was well done then all the trouble in compiling accounts would be worthwhile. Under his final heading, "*The Master Plan*," which he agreed was a bad title, Mr. Harrison said this should be drawn up over the firm's normal accounting year (though perhaps initially once a quarter was possible). The higher executives would be most interested in making comparisons between the actual figures and their budgeted figures. Similarly, the actual totals could be applied to apportion indirect charges, *i.e.* costs incurred on building occupation could be allocated according to floor area of the shops. Production overheads must be measured in a convenient form, often a combination of wages or weight of production. "Fixed" and "variable" charges should be practised all the time so as to be able to pick out the "plums" best suited to the firm's production. Mr. Harrison stressed the importance in finding a unit which suited the particular works and was "fair." Rates of overhead recovery, he said, must be based on normal volumes of business.

Discussion

Both the previous papers were discussed at the next session. One speaker said that in changing to the system recommended, his existing overheads would be altered and asked how these changes could be applied to existing prices to customers. To this question the reply was made that this was a management problem, but selling at a loss at any time (although it might be necessary to individual firms) would "cut the ground from under the feet" of the rest of the industry. Passing on, a further speaker asked about the effects of buying and installing new machines. He was advised always to consult the cost accountant about inevitable economic consequences, which often negatived obvious technical advantages. Following on this, a further question was asked as to the period required to amortize the cost of a new machine or introducing a new process. This depended, he was told, on the type of machine, the output and utilization, but many firms made it a rule that the amount spent on an innovation should show prospect of being recovered in not more than three to five years. In reply to a question on cost of metal melted, Mr. Judd quoted that yield was all important, *e.g.* 45 per cent. yield, 37s. per cwt.; 55 per cent. yield, 33s. per cwt., and 65 per cent. yield, 30s. per cwt., for an assumed price of metal. The perennial question as to whether scrap returned to the cupola should be valued at cost or at its market value was discussed at some length, but one of the lecturers described it as the "proverbial red herring" and said that in the final consideration it made no difference.

"Detailed Considerations of Cost Ascertainment"

After the luncheon interval, the first paper of the afternoon session was given by Mr. H. P. Court and this covered metal and melting costs, moulding, coremaking and dressing costs. The reasons for the desirability of cost ascertainment were (*a*) for the balance sheet, (*b*) for estimating, and (*c*) for control purposes. Control information, he said, must be available first, irrespective of whether or not cost control was incorporated. For wages, it was as important to record both time and money. Mr. Court advocated the splitting up of the pay-roll into sectional activities—but warned his listeners to beware of on-the-spot day-to-day changes. Factors to be considered in compiling details of *Metal and Melting Costs* were listed as (*a*) stock records, (*b*) cupola charge sheet; (*c*) metal poured:

loss in melt; (*d*) records of good castings produced; (*e*) weight of runners, heads, etc: (*f*) valuation of metals; (*g*) computation of costs (*i*) at cupola spout and (*ii*) of good castings. Mr. Court said he preferred a daily cupola charge-sheet and also said that it was desirable to arrive at the weight as accurately as possible of metal poured. In ascertaining the valuation of the metal used, the computation should be checked with initial stock plus purchases minus residual stock over the period. Passing on to *Moulding and Coremaking Costs,* he said that individual job costing was not justified in the majority of foundries. The following considerations should be taken into account:—(*a*) analysis of direct wages to jobs; (*b*) division into sections, where necessary; (*c*) methods of dealing with secondary and indirect labour, and (*d*) application of overheads to product costs. In computing *Dressing Costs,* the different methods of dressing should be considered, *i.e.* hand or machine work. There should also be a record of wages, and output and application of overheads. When considering allocation of overheads, it was important to relate them to a factor most closely tied to production. For example, overheads in the melting department should be allocated on metal weight and in the moulding department, on direct moulding labour. Under *Other Costs,* Mr. Court detailed items such as annealing, pattern-shop work, special processes, office and administration expenses, and selling and distribution expenses. All these, he said, must be taken properly into account. Referring to annealing, Mr. Court said the costs should be grouped as to size to give tonper-hour charges for furnace loading sheets. Piecework schemes when applied to patternmaking, he said, often degenerated into enhanced day rates because of difficulty in estimating. Despatch, packing, etc., should be separated, as some customers might collect their goods and this factor should be taken into account. Maintenance charges could be dealt with in three ways, *viz.*, (*a*) the total could be checked with the output of castings; (*b*) it could be split according to production shops, and (*c*) divided among individual items of plant. It was important to make shops' personnel "maintenance conscious." In one case he know of, this was done by spreading the news that the presence of a green overall (maintenance) man cost the shop 7s. 6d. per hour. He would use departmental operating statements for collating the figures for control purposes.

"Estimating"

The final paper in this one-day conference was given by Mr. W. E. Harrison on "Estimating". First, the Author circulated two forms for (*a*) metal cost computation and (*b*) estimate sheet. He then worked out an estimate for an actual job, namely the production and costing of a domestic-mincer body casting. The costing was based on hypothetical figures, and Mr. Harrison detailed an estimate sheet and cost estimate of producing 10,000 mincer bodies, showing in detail all the factors to be considered and analysing them. Referring to administration charges, if these were based on manufacturing costs, it might be that these would bear unequably for instance between ferrous and non-ferrous productions. Thus, it might be better, he said, to base their cost on conversion cost, *i.e.* raw material to finished metal. The sort of cost estimations which had been outlined could be carried out by one operator on a comptometer (and checked) in about five minutes and had the additional value that they always made use of up-to-date data.

Combined Discussion

After this paper had been given, discussions took place of the two papers given during the afternoon. A question was asked as to how to deal with overheads on a reduced volume of business. It was explained that the excess would show as unrecovered overheads when the total of "fixed" and "variable" overheads was computed. What to do in these circumstances became a management responsibility, but the cost accountant must make his figures reveal the true state of affairs—sometimes a difficult matter. Referring to Mr. Court's view that individual job costing was not justified in the majority of foundries, a speaker asked how could one check a cost and selling price without individual job costing. The reply was that this could be done if required for specific jobs from the figures already available for actual performance data. A further question was put about overheads and the speaker was told that it was possible to separate fixed and variable overheads and then assess the real effect, but there was a limit to the cost accountant's responsibility and it was the manager who should make the decision what to do.

Concluding the conference, the chairman expressed his thanks to the speakers and delegates attending and said he felt from the tone of the discussions that interest in the question of costing and estimating had been well aroused. It had been a most worthwhile day's programme and he was sure the views expressed would be of great help to practical men in the foundry industry.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

BILSTON, August 20—Supply and installation of spun-iron pipes. Deposit £2 2s. 0d. A. M. Williams, Town Clerk, Town Hall, Bilston, Staffs.

BURMA, August 14—Diaphragm suction pumps. (ESB/18237/57.)

CARMARTHEN, August 19—5,590 yds. 3-in. dia. spun-iron pipes, with flexible joints. Conditions, etc., from Herbert Lapworth, Partners, 25, Victoria Street, London, S.W.1. Mr. J. Jones, Clerk, 3, Spilman Street, Carmarthen, Wales.

RHODESIA, September 18—Pneumatic jolt/squeeze strip moulding machines for the Federation of Rhodesia and Nyasaland. (ESB/18497/57.)

STURMINSTER, September 17—Spun-iron sewer and pumping main. Specifications from Lemon & Blizard, Castle Lane, Southampton. Tender to Mr. J. Steptoe, Clerk of the Council, Council Offices, Sturminster, Newton, Dorset.

SUNDERLAND, August 12—Cast-iron rainwater and soil goods for six months commencing October 1, 1957. Mr. G. S. McIntire, Town Clerk, Town Hall, Sunderland.

Company News

NEWALL ENGINEERING COMPANY, LIMITED, Peterborough—The company has acquired Jas. C. Kay & Company, Limited, ironfounders, of Bury (Lancs). A majority holding was acquired by Newall Engineering in 1947 to ensure a supply of high quality castings used in machine-tool production.

FIRTH BROWN TOOLS, LIMITED—Group net profits dropped to £239,545 (£268,614) after charging depreciation of £153,937 (£150,946) and taxation of £340,177 (£375,049). A dividend of 11½ per cent. is recommended for the year to March 31, 1957, on £1,600,000 capital, against 12½ per cent. on £1,300,000.

C.V.A. JIGS, MOULDS & TOOLS, LIMITED—Subject to permission to deal being granted, £1,000,000 of 6½ per cent. debenture stock, 1977-82, has been placed at 99. The company manufactures under licence a number of the products of the Kearney & Trecker Corporation, of Milwaukee, which is subscribing for £500,000 ordinary shares at par.

HACKBRIDGE HOLDINGS, LIMITED (formerly Hackbridge Cable Holdings, Limited)—The company reports lower profits and is halving the final dividend to 10 per cent. for the year ended March 31 last. This makes a 20 per cent. total and compares with 30 per cent. paid for 1955-56. The group net profit of £122,168 goes against £187,105 and is struck after deducting £189,819 (£229,479) for tax.

ANTI-ATTRITION METAL COMPANY, LIMITED—Mr. T. M. Priestley, the chairman, states in a letter to shareholders that the board is still of the opinion that it is in the interests of shareholders to accept the offer by Beyer, Peacock & Company, Limited, in spite of the letter by Mr. S. J. Patmore urging rejection of the offer. The board, says Mr. Priestley, took "all relevant factors" into consideration in recommending the offer, which expired on August 2.

SHEEPBRIDGE ENGINEERING, LIMITED—A final dividend of 10 per cent. makes a total of 15 per cent. on the reorganized capital of £3,000,000 for the year ended March 31 last. This is virtually the same distribution as for 1955-56, when 22½ per cent. was paid on the £1,990,372 combined participating preference and ordinary capital. Group trading profits amounted to £1,314,002, against £1,328,065, but the net profit, after higher tax and depreciation provisions, is down from £518,788 to £394,722.

Birfield Forms New Company

A new company—Railko, Limited—has been formed by Birfield, Limited, to acquire the Railko engineering bearings and laminates department of Small & Parkes, Limited, manufacturers of engine packing, textile belting and brake lining, laminates, etc., of Manchester. This is not a new association for Birfield as its subsidiary, Laycock Engineering, Limited, has for the past eight years acted as general sales agents for Railko's railway applications.

Arrangements for continuity of production, delivery, research, and development, pending the erection of the new factory, have been made with Small & Parkes, Limited. Mr. A. H. Parkes, deputy chairman and managing director of Small & Parkes, Limited, is to be a member of the board of the new company, and Mr. R. G. Walmsley, who has been in charge of Railko development at Small & Parkes, will be director in charge of the new Railko factory to be erected at Loudwater (Bucks).

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

767,218. Regie Nationale des Usines Renault, 8-10, Avenue Emile Zola, Billancourt (Seine), France.

A method of locating a model or cluster of models in a mould for precision casting by the "lost-wax" process. The model (or models) is arranged to be an easy fit on a rod passing through the removable bottom plate, in the shape of an inverted funnel, of a moulding box. The moulding box is placed over the rod. The interior of the moulding box is then filled with refractory material, inverted and the bottom plate and rod removed.

767,242. Haylis Controls Organisation, Neena, Winnebago, Wisconsin, USA.

An apparatus for automatically measuring, mixing and delivering, foundry sand from a storage bin to an individual moulder's hopper.

775,508. Goodyear Tire and Rubber Company, 1,144, East Market Street, Akron, Ohio, USA.

Apparatus for casting tyre-mould segments in particular those having undercut rib portions. The casting is usually done by the "lost-wax" process or by casting and then cutting the undercut portion into the sidewall of the ribs. These are costly processes and the patentees therefore make use of die-casting.

775,512. International Smelting and Refining Company, 25, Broadway, New York, USA.

The invention relates to the casting of copper and deals particularly with large copper cakes.

New Napier Company

To handle growing business interests in America, D. Napier & Son, Limited, aero and marine engineers, etc., a subsidiary of the English Electric Company, Limited, has formed a new company in the US—Napier Engines Incorporated, with headquarters in Washington, DC. Hitherto, Napier's interests in America have been handled by technical representatives.

The principal aims of the new company are to sell Napier's products; to make contacts with customers for the overhaul of Napier engines; to subcontract the overhaul and servicing of Napier engines; and to provide and distribute spare parts.

President of the new company is Mr. H. Sammons, managing director of D. Napier & Son, and the executive vice-president is Mr. J. C. K. Shipp, who has for some time represented the aviation interests of the English Electric group in the US.

Automation Merger Recommended

A merger "in the best interests of shareholders of both companies" is recommended by the directors of Elliott Bros. (London), Limited, manufacturers of electrical measuring instruments, and Associated Automation, Limited. The merger would be effected by forming a holding company with Mr. R. E. F. de Trafford, chairman of Elliott Bros., as chairman.

The holding company would issue its ordinary shares in exchange for the ordinary shares of the companies in the following proportions:—Eight 5s. shares for every four 5s. shares in Elliott; and eight 5s. shares for every five 10s. shares of Associated Automation.

Factories (Ionizing Radiations) Special Regulations*

Preliminary Draft of a New Code of Safeguards

The Minister of Labour and National Service has published the preliminary draft of a new code of regulations to safeguard those employed in industry against the effect of ionizing radiations. Though an extract from the Regulations is set out below, it is preferable for founders to buy the publication, as interested parties desiring modifications to the proposals must make representations to the Secretary, Ministry of Labour and National Service, 19, St. James's Square, London, S.W.1, before October 31. Part I of the Regulations carries a long list of definitions and includes the conditions under which exemption certificates can be granted. Part II deals with precautions of general application and includes the following 15 Regulations:—

Notification of Use of Ionizing Radiations

6. The occupier shall give not less than one month's notice in writing to the inspector for the district, or such shorter notice as the inspector may agree to accept:—

(*a*) before undertaking for the first time in the factory work involving exposure of persons to ionizing radiations; or (*b*) before carrying out substantial extensions or modifications to apparatus or plant emitting or protecting against ionizing radiations.

Wilful Exposure to Ionizing Radiations

7. No person shall wilfully and unnecessarily place himself or be placed, without adequate protection, in a useful beam of X-rays or in a field of other ionizing radiations.

Age Limits.

8. No person under the age of 18 shall be employed in the processes.

Storage of and Work with Sources of Ionizing Radiations.

9. The storage of, and all work associated with, a source of ionizing radiations shall be so arranged and conducted as to afford adequate protection.

Assessment of Adequate Shielding

10.—(1) For the purpose of assessing whether adequate protection or adequate shielding has been provided in respect of plant and apparatus in the factory, the occupier shall provide an appropriate and efficient radiation dosemeter or dose rate meter; and he shall ensure that it is tested when first brought into use in the factory and that it is re-tested subsequently at least once in every period of 14 months and after any extensive repairs to it.

(2) In the case of X-ray tubes and sources of gamma rays being tubes or sources in other than a permanent installation, the competent person appointed in accordance with the requirements of Regulation 20 hereof, or some other responsible person, shall make appropriate measurements by means of the radiation dosemeter or dose rate meter at least once in every period of three months.

(3) A record of the results of all the tests referred to in paragraph (1) of this Regulation and of all the measurements referred to in paragraph (2) thereof shall be entered in or attached to the health register.

Tests of Personal Exposure to Ionizing Radiations

11. The occupier shall make arrangements for the wearing by every person employed in the processes of a suitable photographic film and, where the Chief Inspector so requires in writing addressed to the occupier, an appropriate and efficient radiation dosemeter during the full working period in which that person is liable to be exposed to ionizing radiations. It shall be the duty of the persons employed to wear such films and, where the Chief Inspector so requires as aforesaid, such dosemeters accordingly. The occupier shall obtain the films from an approved laboratory and arrange for the films, identified with reference to the particular wearer, to be examined at that laboratory and for the issue to the occupier, by the director or other competent person at the laboratory, of certificates as to the dose represented by the results of the examination of each film. The certificates shall be attached to the health register, and the doses recorded on the certificates and, where a dosemeter is required to be worn, by the dosemeter shall be entered in the health register.

Construction and Handling of Sealed Sources

12.—(1) To facilitate remote handling every sealed source shall be so constructed that remote-handling devices can be used with it.

(2) No sealed source shall be handled by other than remote means.

Maintenance of Sealed Sources

13.—(1) Where any sealed source is corroded or damaged or where there are other reasonable grounds for believing that it is leaking or is likely to leak it shall be sealed in an air-tight container forthwith and shall not be brought into use again until it has been effectively repaired.

(2) Every sealed source shall be examined for leakage by a competent person once in every period of 26 months. Records of such tests shall be entered in or attached to the health register.

Breakage of a Sealed Source

14. In the event of breakage during use of a sealed source, the workroom or other workplace shall be immediately vacated, and pending the recovery and removal of the radioactive substance by a competent person or persons, properly equipped for the purpose, all practicable measures shall be taken to prevent the dispersal of the radioactive substance. Notification of the occurrence shall be made forthwith to the inspector for the district.

Loss of a Sealed Source

15. If any person has reasonable grounds for believing that he has lost or mislaid any sealed source he shall notify the occupier accordingly forthwith. On receipt of such notification the occupier shall inform the inspector for the district forthwith after satisfying himself that the sealed source is lost.

Storage of Sealed Sources

16.—(1) Where the sealed sources are liable to release a radioactive gas their place of storage shall be efficiently ventilated to the open air by mechanical means for not less than two minutes before it is opened.

(2) Sealed sources shall be removed from their place of storage only by a person authorized in writing by the

* From Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2; price 11d. post free.

Ionizing Radiation Regulations

occupier, and for the shortest time necessary.

Register of Sealed Sources

17.—(1) Subject to the provisions of paragraph (3) of this Regulation, a register shall be kept showing the following particulars in respect of every sealed source, that is to say:— (*a*) the serial number or other particulars sufficient to identify the sealed source; (*b*) the nature of, and the maximum radioactive strength of, the radioactive substance in the sealed source; (*c*) the date of receipt of the sealed source into the control of the occupier; and (*d*) the date and manner of disposal of the sealed source when it leaves the control of the occupier.

(2) Subject to the provisions of paragraph (3) of this Regulation, at least once in every working day the occupier or a person appointed for the purpose in writing by the occupier shall satisfy himself that each sealed source is satisfactorily accounted for. A note shall be made in the aforesaid register accordingly on the same day.

(3) Nothing in this Regulation shall apply to any sealed source that is used, or intended to be used, as a fuel element in a nuclear reactor, or to sealed sources in the course of their being manufactured.

Transport of Sealed Sources

18.—(1) Sealed sources shall be transported between the storage place and the place of use within such protective receptacles, or by such remote handling or automatic methods, as ensure adequate protection to all persons.

(2) All protective receptacles used for the transport or handling of sealed sources shall be distinguished by orange markings.

Direction and Size of Useful Beam

19—(1) Wherever practicable the useful beam shall be directed away from adjacent occupied areas.

(2) The cross-section of the useful beam shall be limited to the minimum necessary for the work.

Appointment of a Competent Person

20. The occupier shall appoint a competent person to exercise special supervision with regard to the requirements of these Regulations and to assist by instruction in safe working methods, monitoring, and otherwise, in enforcing the observance of them. The name of the person so appointed shall be kept posted up in the factory where it may be conveniently read by the persons employed in the processes.

Part III details the Regulations governing medical supervision and examination.

Recent Wills

BENTLEY, P. A., chairman of the Bentley Engineering Group, Limited, Leicester £198,145

RAIKES, COL. W. T., managing director of Fullers' Earth Union, Limited, Redhill (Surrey) £58,282

LLOYD, HEDLEY, export director of Marsh Bros. & Company, Limited, steelmakers, etc., of Sheffield £18,374

HORSTMANN, ALBERT, former managing director of the Horstmann Gear Company, Limited, Bath (Somerset) £31,554

BRAMLEY, E. H., general manager and a director of Walker Bros., Limited, constructional engineers, etc., of Walsall £4,929

LUBBOCK, M. F. P., chairman of Production-Engineering, Limited, and a director of Rolls-Royce, Limited, and other companies £125,271

SMITH, R. H., a director of Smith & Company (South Shields), Limited, ironfounders, a past president of the Newcastle branch of the Institute of British Foundrymen £8,275

BRETTELL, W. A., co-founder and chairman of Brettell & Shaw, Limited, ironplate workers, galvanizers, etc., of Brierley Hill (Staffs), and a director of of Thorneycroft-Brettell, Limited, manufacturers of steel pressings, etc., of Wolverhampton ... £14,470

Personal

Mr. A. L. MOUNTER, has resigned from his position of chief buyer for C.V.A. Jigs, Moulds & Tools, Limited, Hove, with effect from August 31.

Mr. ALAN GRAHAM, managing director of Perry Barr Metal Company, Limited, a subsidiary of Birmid Industries, Limited, has severed his connection with the company.

Mr. G. G. ROBERTS, M.SC., formerly director of research to Smiths Aircraft Instruments, Limited, at Cheltenham has now been appointed technical director, succeeding upon the resignation of Mr. E. B. Moss.

Mr. K. S. PEACOCK, a director of United Steel Companies, Limited, has been elected chairman of Guest Keen Iron and Steel Company, Limited. He is already chairman of the parent company, Guest Keen and Nettlefolds, Limited.

Mr. J. F. HERBERT has been appointed to the newly created post of manager, overseas atomic projects, with the English Electric Company, Limited. He has also been elected a director of English Electric Export & Trading Company, Limited.

MONSANTO CHEMICALS, LIMITED, announce that operations are now divided between two new divisions—the chemicals and plastics divisions. Mr. D. R. MACKIE has been appointed director of the former in addition to his duties as managing director and Dr. J. W. BARRETT has been appointed director of the latter in addition to his duties as technical director.

Mr. EDGAR P. HEATHER has been appointed a director of Wadkin Limited, Leicester, as from August 1. Mr. Heather, who joined the company as technical representative in 1931, and for the last 15 years has been London manager, will continue to direct the sales and service in that area for the Wadkin group of companies from the London office, 62 Brook Street, W.1.

Obituary

Mr. C. J. WEBB, chief chemist at the Sheepbridge Company, Limited, Chesterfield, has died at the age of 54. He had been with the company for almost 38 years and became chief chemist in June, 1950. He was an associate in metallurgy of Sheffield University and an associate of the Institution of Metallurgists.

The death is announced of Mr. R. B. WHITE, the technical representative of Armstrong Whitworth (Metal Industries), Limited, in the Midlands area, where he worked with Mr. J. Bell, the area manager. Mr. White possessed a quiet friendly manner and was well liked by his colleagues and by those with whom he came into contact.

The death took place on July 29, of Mr. L. K. BRINDLEY, consultant to the president of the International Nickel Company of Canada, Limited, who, at his retirement last February, was deputy chairman of the Mond Nickel Company, Limited. Mr. Brindley joined Mond Nickel in 1948, following his resignation from the Falconbridge Nickel Company, Limited, of which company he had been president. He became a director of Mond Nickel in December, 1948, managing director in January, 1951, and deputy chairman in May, 1955. At the time of his death he was a director of the Anglo Metal Company, Limited, and also deputy chairman of the Council of the Copper Development Association.

Company Meeting

The Wolverhampton Metal Co.

A MOST SUCCESSFUL YEAR

The 54th annual general meeting of The Wolverhampton Metal Co., Limited, was held on August 2 in Birmingham, MR. THOMAS C. JAMES (Chairman and Joint Managing Director) presiding.

The following is an extract from his circulated statement:—

The year ended March 31, 1957, has been again a most successful one for your Company. This year has been of particular interest for the following reasons: (1) The Group Profits of £627,162 show an increase of £16,683 on the figure for 1956 which itself was a record in the history of the Group; this result has been achieved in spite of the very heavy fall in the price of copper. The home subsidiaries and branches again made a substantial contribution to the total. (2) This profit has been attained with a somewhat higher production notwithstanding the increasingly difficult raw material supply position. (3) In my Statement last year I referred to the continuing fall in the price of Copper, the main metal in which we are interested. During the year under review the price fell from £397 at the beginning of April, 1956, to £241 at the end of March, 1957 (a fall of £156 in 12 months), but by our prudent trading policies we were able to avoid the considerable stock losses which might have arisen. (4) In August, 1956, as we had anticipated, the Warspite Salvage venture was satisfactorily completed, giving a separate non-recurring profit.

The profit on Warspite to completion amounts to £16,980 which, with the balance in credit at the beginning of the year—£35,000—gives a total surplus on the venture over the period 1949 to 1956 of £51,980. Taxation assessable on this amounts to £23,500, leaving a balance of £28,480 which has been transferred to General Reserve.

Group Profit has been well maintained at £627,162 (after provision of £70,944 for Depreciation). Taxation assessable thereon is £322,837; the minority interest is £2,543; the contribution to the Employees' Service Fund is £3,000. After deducting these items the balance available for appropriations and distribution is £298,782 as compared with £298,145 last year.

The Board recommend as Final Dividend a payment of 17½ per cent., making a total distribution for the year of 27½ per cent., less Income Tax, this being the same as in the previous year.

Future Outlook

I referred last year to the increasing scarcity of raw materials. We are still faced with this problem and there has been a tendency for margins to become narrower due to keen competition. You will be aware that our expenditure on modernization and new plant has placed us in a position where we can profitably process materials with very low metal content through to the finished product. By this means we can derive some benefit for our accumulation of waste products and this will help to make good some of the deficiency in supplies from other sources.

To meet these new conditions, we are still further improving our production methods and plant, so achieving increased efficiency and reducing the costs of treatment.

There is also a promising field in treatment of our by-products and we are actively engaged on research with this in view. Progress already made is encouraging.

Trading conditions in our industry are less favourable than last year and if such conditions continue it may be impossible to maintain the high level of profits of the year under review. Nevertheless, I am hopeful that with the policy I have outlined, backed by ample resources at our disposal and the benefits of over 50 years of experience, we shall be able to give a satisfactory account of our stewardship.

The report was adopted.

BCURA Annual Report

The annual report of the British Coal Utilization Research Association for 1956 contains the following paragraphs of interest to the foundry industry:—

Domestic Heating

Considerable interest at home and overseas is being taken in the small-pipe forced-circulation central-heating system. This system can make the benefits—efficiency, adaptability and use of smokeless fuels—of central heating more readily available because it is relatively easy to install even in existing houses, and it has other advantages in use. In field trials the BCURA automatic temperature controller, actuated by the outdoor temperature, has been found satisfactory, and this is to be manufactured by a member-firm under licence.

The potential efficiency of domestic heating is also increased by the freestanding convector fire with restricted throat, owing to its economy in fuel; moreover, it can make the available supplies of smokeless fuels go further. Tests with this appliance in a London block of flats have shown that it can also overcome downdraught conditions, and these appliances are now being installed in considerable numbers in local authority dwellings. Progress is being made in the development of a small stoker that can burn certain small coals for heating flats and public buildings. As a result of modifications of the ignition arch and to the secondary air supply, smokeless combustion has been achieved under various conditions; attention will now be directed to automatic control and fuel handling, which are especially important in these conditions.

Flue Dust

Another aspect of air pollution is the dust emitted from industrial chimneys, and accurate measurement of the dust burden in flue gases has in the past proved difficult. The versatility of the BCURA dust-sampling probe has now been increased by the provision of interchangeable components; field tests have shown that it can be used satisfactorily in conjunction with many different types of boiler, and even above 700 deg. C. Particle-sizing equipment for general industrial use is also being developed in collaboration with a member-firm. It has been found that coarse friable grit is best measured by means of a horizontal settling tube; this work is guided by a committee of the British Standards Institution.

Coal Grindability

The cone mill, though designed primarily for the study of the matrix theory of coal breakage, promises to be a valuable machine for pulverizing coal with improved efficiency. A recirculation system has been provided on a small mill, and a pilot design is being developed for industrial use.

News in Brief

SUFFICIENT ACCEPTANCES from Sheffield for the New York World Trade Fair, next April, have been received to ensure that Sheffield will definitely have a stand there.

W. A. HOLDSWORTH, Bradford, have been appointed sole distributors for the Yorkshire area by R. H. Neal & Company, Limited, for their full range of cranes. At the moment, Holdsworth's are in the process of moving office to Leeds where a new depot will be opened shortly.

COLOURED WORKERS in Sheffield may be asked to "contract" to stay in their jobs for two years according to a proposal likely to be considered by the Sheffield Trades and Labour Council. The suggestion has been put forward because of the way in which some coloured people drift from one job to another.

MCLOUGHLIN'S CASTINGS, a new company, has started production at Wyre Street Foundry, Padiham, Lancs. The firm is to carry on the earlier business of making firegrate and plumbers' castings, and castings for the general engineering trades. In a month's time about 15 workers will be employed there, some of them having worked for the previous occupier before the foundry closed about a year ago.

AN AGREEMENT IS ANNOUNCED, operative from July 1, whereby Clark Equipment International C.A. has become an equal partner with the Austin Motor Company, Limited, and Crompton Parkinson Limited, for operating I.T.D. Limited, an organization which has been marketing the Stacatruc fork-lift truck and Electricar platform truck. Under this agreement I.T.D. Limited, will have available Clark patents, designs and technical experience covering a wide range of mechanical handling equipment.

The display of the English Steel Corporation, Limited, on stand No. A43, at the British Trade Fair and Exhibition, Helsinki, September 6 to 22, will include, *inter alia*, steel castings, engineers' cutting tools, permanent magnets, and samples of high speed, carbon and alloy tool steels. Photographs will be used to illustrate machine shop operations and some of the heavier products made by the company. A 50-min. sound film entitled "Engineers in Steel," which briefly describes the activities of the Corporation, will also be shown.

THE VERNON FOUNDRY, Newbridge-lane, Stockport, Cheshire, celebrated its golden jubilee on July 31. On that date in 1907, the late Mr. P. B. Wolfe started the foundry in a farrier's shop which adjoined Stanley House. Subsequently the stables of Stanley House were incorporated and eventually the house itself was demolished to make way for the building of the new office block. Mr. Wolfe retired in 1937, and Mr. J. Reynolds Clayton, now the president of the Manchester and District Iron Founders' Employers' Association, took over control of the firm.

Mr. CLIVE COOKSON, chairman of the Consett Iron Company, Limited, has presented a railway medal which belonged to his grandfather, Mr. William Isaac Cookson, to the Railway Museum at York to add to its collection of historical relics. The Newcastle and Carlisle Railway Company presented all its directors with an inscribed silver medal which entitled the holder to free travel on any of the company's trains. Mr. Cookson's grandfather became a director in 1846, and was presented with one of these medals which has now been given to the museum.

Mr. F. N. LLOYD, chairman and managing director of F. H. Lloyd & Company, Limited, told the annual general meeting at James Bridge Steel Works, Wednesbury, on July 25, that as the company's foundry departments are, without exception, working at full stretch, a further stage in their development is being initiated; the aim being to make more large steel castings. He added that during the past year American processes for engineered and precision ferrous castings and heat-resistant alloy castings had become available to the group by agreement with the American Brake Shoe Company.

THE EXPORT CREDITS GUARANTEE DEPARTMENT is notifying policyholders that it is suspending cover on new business with Colombia from August 1. Short-term contracts already made (where the exporter has "contracts" cover) or exports already made (in the case of "shipments" cover) remain covered by insurance, as does medium-term business already insured. Current firm offers of insurance will stand but will not be renewed on expiry. This action has been taken to limit the Department's liabilities in the market in view of substantial exchange delays and of the unsettled outlook still persisting: it is hoped that an improvement in conditions may permit an early resumption of cover.

NINE MONTHS after obtaining a manufacturing licence, the National Gas and Oil Engine Company, Limited, Ashton-under-Lyne, announce that the first National GS34 free-piston gasifyer has completed initial running tests. With the exception of one proprietary component the Gasifyer is of all-British manufacture, and is claimed to be the first such unit to run. The majority of component production and all the assembly work has been undertaken at the company's works; the fuel-injection equipment has been supplied by Bryce Berger, Limited, of Staines. The engine, in conjunction with a suitable gas turbine, provides power in single and multiple units from 1,000 to 20,000 h.p. for electrical generating sets, etc.

SHEFFIELD has about 42,000 industrial savers, said Mr. C. Stacey, assistant commissioner of Sheffield Savings Committee at a meeting of the city's industrial sub-committee on July 24. He added, "We hope to increase this number during the six months' campaign by at least 4,000—and also to increase the number of savings groups in industry." It has been agreed that letters should be sent to managing directors of firms with savings groups suggesting an attempt to increase membership by 10 per cent., and to firms without groups proposing the formation of one. Support is also to be sought from local trade union secretaries, and the first three industrial groups with the highest percentage of increases in membership will be awarded with certificates of merit.

THE BOARD OF TRADE announced on December 7, 1956, that they were about to make arrangements for reducing their stocks of zinc, and they have now decided to sell about 27,000 tons of zinc in a period of not less than nine months beginning September, 1957. The first sales will be of about 9,000 tons for delivery and pricing over the three months September to November. The disposal of the remaining 18,000 tons in two or more subsequent three-monthly periods will be the subject of further announcements from time to time. Of the 27,000 tons, about 9,500 tons will be offered for sale by open competitive tender. The tender for the three months September to November will be for 3,200 tons. The remaining 17,500 tons will be offered to the original suppliers or their agents.

Raw Material Markets

Iron and Steel

The amount of the increases in iron and steel prices was, perhaps, greater than was anticipated. The foundries will certainly not be able to withhold passing on the increase, or at least a portion of it, to the consumers, as with the advances in the prices of fuel, scrap, freight, etc. their production costs will be increased appreciably. They fear, however, that the increased prices will be a further obstacle in securing the business which so many of them need to keep their establishments fully employed.

Meanwhile, with so many foundries closed for holidays, production of castings is greatly reduced, as is also the delivery of raw materials. The blast furnaces continue to produce their normal outputs of pig-iron and for the time being additional tonnages in the foundry grades are being placed into stock. The low-phosphorus irons are, however, mostly covered by allocation and producers will have no difficulty in disposing of their outputs when work is resumed. Some of the engineering foundries are taking in supplies during their holiday. Hematite pig-iron is in good supply, as well as the high-phosphorus irons, and the surplus available after home requirements have been met enables bigger tonnages to be offered for export.

In the home market the increases in the prices of both billets and the finished product are not likely to interfere with business—at least for some time ahead. Many of the re-rollers are closed for holidays and between now and the end of August holiday influences will have a strong bearing on outputs and also on the demand for steel semis. The re-rollers have fairly good order-books and have sufficient steel to fulfil their commitments. In addition to the tonnage which home steelworks offer, some consignments also continue to be available from abroad.

Non-ferrous Metals

After the steadiness imparted to the copper market by the strike of the European rockbreakers on the Northern Rhodesian Copperbelt the market has once again been sinking to lower levels. Demand for copper is reasonably good, but fears are being expressed as to whether any upsurge in market demand will be sufficiently great or sustained to absorb in the next few months the weight of supplies overhanging the market. Production trends still appear to be upwards. Chile produced over 9 per cent. more copper in the first four months of this year than in the corresponding period a year ago and it is known that Northern Rhodesia, despite the cut-backs in production, has also increased its total output of the red metal. In London the contango is trying to widen. The US market remains quiet with no changes of note in the price structure.

The tin market showed its phlegmatic character this week when it was unresponsive to the news that the impending release of the 3,000 tons of tin from the Canadian stockpile would not be made until the price reached £830 a ton. With easier conditions in the East the London price has weakened, as has the quotation in the US to 95½ cents a pound. However, one item of note is that US tinplate production in April, at 709,487 tons, was an all-time monthly record. The backwardation is tending to narrow in London as stocks continue to mount.

Lead continues quiet here and fairly steady on the other side of the Atlantic, where the price remains at 14 cents a pound.

Zinc is in much the same position as lead, although its statistical position is much weaker and reports are still coming in about mines, mainly zinc, closing down. The recent statement that both lead and zinc would be stockpiled has not helped to clear the air and with consumers reluctant to enter the market it is doubtful whether the present price of 10 cents a pound will hold even though it is uneconomical to a great many producers.

Increases in Capital

MINSTER ENGINEERING COMPANY, LIMITED, York, increased by £5,000, in £1 ordinary shares, beyond the registered capital of £5,000.

MINING & METALLURGICAL AGENCY, LIMITED, London, E.C.2, increased by £20,000, in £1 shares, beyond the registered capital of £20,000.

GANABUEN ENGINEERING COMPANY, LIMITED, London, S.E.11, increased by £49,000, in £1 ordinary shares, beyond the registered capital of £100.

HOLO-KROME, LIMITED, precision engineers, etc., London, W.C.2, increased by £199,900, in £1 shares, beyond the registered capital of £100.

ROSS & COMPANY (FOUNDRY), LIMITED, Killamarsh, Sheffield, increased by £95,000, in £1 ordinary shares, beyond the registered capital of £5,000.

RHODES & HOLMSHAW, LIMITED, engineers, etc., of Ossett (Yorks), increased by £19,000, in £1 shares, beyond the registered capital of £1,000.

ROWHEDGE IRONWORKS COMPANY, LIMITED, Rowhedge (Essex), increased by £52,000, in £1 ordinary shares, beyond the registered capital of £8,000.

MALLEABLE MOULDINGS (DEAL), LIMITED, London, W.C.2, increased by £5,000, in £1 ordinary shares, beyond the registered capital of £5,000.

MEADOW FOUNDRY COMPANY, LIMITED, Mansfield (Notts), increased by £15,000, in £1 ordinary shares, beyond the registered capital of £50,000.

JAMES NEILL & COMPANY (STEELS), LIMITED, Sheffield, 11, increased by £10,000, in £1 ordinary shares, beyond the registered capital of £70,000.

DERITEND STAMPING COMPANY, LIMITED, Birmingham, 9, increased by £250,000, in 10s. ordinary shares, beyond the registered capital of £500,000.

SANKEY-TELCON, LIMITED, metal casting manufacturers, of London, W.C.1, increased by £50,000, in £1 shares, beyond the registered capital of £20,000.

HIGHFIELD LEAD MILLS, LIMITED, Liverpool, increased by £89,900, in 200 "A" and 87,700 "B" shares of £1 each, beyond the registered capital of £100.

MURRAY & LUNT, LIMITED, engineers, pattern and model makers, etc., of Liverpool, increased by £7,000, in £1 shares, beyond the registered capital of £3,000.

CONTRACTORS' SERVICES, LIMITED, engineers, etc., of London, S.W.2, increased by £24,000, in £1 "B" non-voting shares, beyond the registered capital of £1,000.

ROBERT BROADBENT & SON, LIMITED, ironfounders, etc., of Stalybridge (Ches), increased by £35,000, in £1 ordinary shares, beyond the registered capital of £35,000.

INTERWOOD, LIMITED, ironfounders, engineers, etc., of London, E.C.1, increased by £30,000, in £1 ordinary shares, beyond the registered capital of £20,000.

DON FORGE & ENGINEERING COMPANY, LIMITED, Sheffield Road, Rotherham, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £20,000.

M. B. WILD & COMPANY, LIMITED, ironfounders, engineers, etc., of Birmingham, increased by £200,000, in £1 ordinary shares, beyond the registered capital of £100.000.

ALFRED STEEL & SONS, LIMITED, roller and pulley, etc., manufacturers, of Sheffield, increased by £26,500, in £1 ordinary shares, beyond the registered capital of £13,500.

REX ARNOLD & COMPANY, LIMITED, sheet metal workers, etc., of Kings Norton, Birmingham, 30, increased by £20,000, in £1 shares, beyond the registered capital of £10,000.

BIGGS WALL & COMPANY, LIMITED, gas, water and general engineers, etc., of London, N.10, increased by £24,000, in £1 ordinary shares, beyond the registered capital of £6.000.

CERTON, LIMITED, manufacturers of mechanical and electrical apparatus, etc., of London, E.18, increased by £12,000, in £1 ordinary shares, beyond the registered capital of £12,000.

BLACK-CLAWSON INTERNATIONAL, LIMITED, engineers, etc., of London, W.1, increased by £400,000, in 3,200,000 ordinary shares, of 2s. 6d. beyond the registered capital of £250,000.

JOHN S. TREGONING & COMPANY, LIMITED, iron and steel manufacturers, etc., of Llanelly, increased by £175,000, in £1 ordinary shares, beyond the registered capital of £100.000.

HARRISON & CLOUGH, LIMITED, nut, bolt, and screw makers, engineers, etc., of Keighley (Yorks), increased by £10,000, in £1 ordinary shares, beyond the registered capital of £3,000.

BROWN & SHARPE, LIMITED, manufacturers of screw machines, etc., of London, S.W.1, increased by £250,000, in £1 ordinary shares, beyond the registered capital of £250,000.

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

August 7, 1957

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S. 1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £50 0s. 0d. to £53 5s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £70 0s. 0d. to £76 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 28s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 9s. 5d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 12s. 5d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £96 0s. 0d. to £99 10s. 0d., basis 60 per cent. Cr, scale 33s. 0d. per unit; over 6 per cent. C, £94 0s. 0d., basis 60 per cent. Cr, scale 31s. 0d. to 33s. 0d. per unit; 2 per cent. C,* 2s. 2d. per lb. Cr.; 1 per cent. C,* 2s. 2½d. per lb. Cr; 0.15 per cent. C,* 2s. 3d. to 2s. 3½d. per lb. Cr; 0.10 per cent. C,* 2s. 3½d. to 2s. 3⅝d. per lb. Cr; 0.06 per cent. C,* 2s. 3½d. to 2s. 4d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £290 0s. 0d.; 96/98 per cent., £310 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 22s. 0d. to 23s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £87 19s. 3d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £33 1s. 6d.; tested, 0.08 to 0.33 per cent. C, £34 1s. 6d.; hard (0.41 to 0.60 per cent. C), £35 3s. 0d.; silico-manganese, £44 2s. 6d.; free-cutting, £37 5s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 7s. 0d.; silico-manganese, £44 10s. 0d.

* Average 68-70 per cent.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 18s. 6d.; acid, up to 0.25 per cent. C, £43 10s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 12s. 0d.; boiler plates (N.-E. Coast), £45 2s. 0d.; floor plates (N.-E. Coast), £44 1s. 0d.; angles, N.-E. Coast, £40 6s. 6d.; joists, N.-E. Coast, £40 2s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in. and flats, 5 in. wide and under, untested soft basic, 50 tons and over, £40 8s. 0d. (under 10 tons to 4 tons, £41 5s. 6d.; under 4 tons to 2 tons, £41 10s. 6d.); hoop and strip coils, £40 10s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £45 16s. 0d.; black sheets (hand mill), 24 g., £59 4s. 6d.; galvanized corrugated sheets, 24 g., £68 17s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £69 9s. 6d., nickel-chrome, £100 12s. 6d.; nickel-chrome-molybdenum, £112 16s. 6d.

NON-FERROUS METALS

Copper.—Cash, £210 15s. 0d. to £211 0s. 0d.; three months, £213 15s. 0d. to £214 5s. 0d.; settlement, £211 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 1d. per lb.; rods, 249s. 9d. per cwt. basis; 20 s.w.g., 283s. 0d. per cwt.

Tin.—Cash, £740 10s. 0d. to £741 0s. 0d.; three months, £741 0s. 0d. to £741 10s. 0d.; settlement, £741 0s. 0d.

Lead (Refined Pig).—First half August, £92 0s. 0d. to £92 5s. 0d.; first half November, £92 5s. 0d. to £92 10s. 0d.

Zinc.—First half August, £73 12s. 6d. to £73 15s. 0d.; first half November, £73 5s. 0d. to £73 10s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £106 15s. 0d.; rolled zinc (boiler plates), all English destinations, £106 15s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £90.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 8¾d. per lb.; rods, drawn, 2s. 11d.; sheets to 10 w.g., 183s. 9d. per cwt.; wire, 2s. 5¼d.; rolled metal, 183s. 9d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £147; B6 (85/15), — ; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £200; HTB2 (38 tons), — ; HTB3 (48 tons), — .

Gunmetal.—BS1400, LG2 (85/5/5/5), £186; LG3 (86/7/5/2), £199; G1 (88/10/2/½), — ; (88/10/2/1), — .

Phosphor Bronze.—BS1400, PB1 (AID released), — per ton.

Phosphor Bronze Strip, etc.—Strip, 267s. 9d. per cwt.; sheets to 10 w.g., 287s. 0d. per cwt.; wire, 3s. 9¾d. per lb.; rods, 3s. 1¾d.; tubes, 3s. 2¼d.; chill cast bars: solids 3s. 1¾d., cored 3s. 2¾d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 8d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 0¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 11¼d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £87 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.; aluminium bronze (BS1400), AB1, — ; AB2, — .